

Memoirs of the

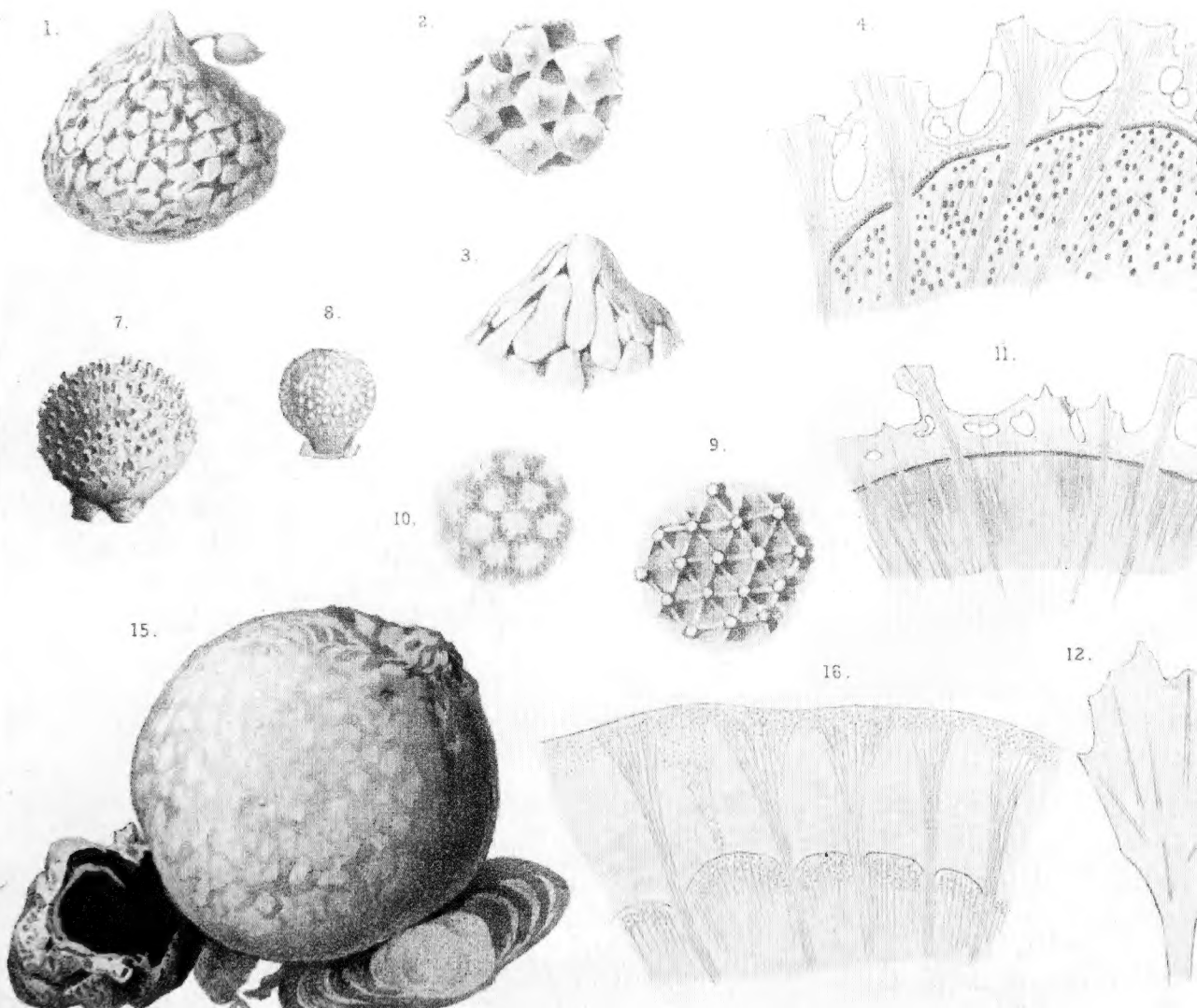
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"The Voyage of H M S "Challenger"



Cover. Part of the last plate in the Challenger Report on the Tetractinellida written by W. J. Sollas and published in 1888. It illustrates three species of *Tethya* with chiefly Indo-West Pacific distribution. Figures 15 and 16 show a large specimen of *Tethya ingalli* Bowerbank, fixed on foreign objects and dredged by HMS "Challenger" in Bass Strait from a depth of 70 metres. This is one of the most common sponges along the coast of southern Australia, particularly in the bays of Victoria in shallow water and is described in this report.

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MELBOURNE AUSTRALIA

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Instructions to Authors

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DEMOSPONGIAE (PORIFERA) FROM NORTHERN BASS STRAIT,
SOUTHERN AUSTRALIA

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Abstract

Wiedenmayer, F., 1989. Demospongiae from northern Bass Strait, southern Australia. *Memoirs of the Museum of Victoria* 50(1): 1-242.

Eighty-four species (in 47 genera) in the Museum of Victoria, Melbourne, are described and illustrated. Of these, 21 species are described as new: *Ancorina repens*, *A. suina*, *Stelletta arenitecta*, *Rhabdastrella cordata*, *R. intermedia*, *Tetilla praecipua*, *Latrunculia hallmanni*, *Pseudaxinella decipiens*, *Reniochalina sectilis*, *Rhaphoxya felina*, *Clathria wilsoni*, *Echinoclathria egena*, *Psammoclema bitextum*, *P. fissuratum*, *P. goniodes*, *P. radiatum*, *P. stipitatum*, *P. van-soesti*, *Calyspongia persculpta*, *C. toxifera*, and *Thorecta glomeratus*. Eighteen records are new for the Maugean province, and three (*Phorbas tenacior*, *Darwinella gardineri*, and *Gelliodes incrustans*) are new for the Australian fauna. The following revisions depart from those adopted in Wiedenmayer et al. (in press). The family Desmacididae is divided into Desmacidinae and Stylotellinae, and the genera *Stylorella* (= *Batzella*), *Phoriospongia* (= *Chondropsis*), and *Psammoclema* (= *Psammopemma*, *Sarcocornea*) are assigned to the latter. *Dactylia*, *Chalinopsilla* and *Arenosciera* are synonymised with *Calyspongia*. *Thorectandra* is synonymised with *Thorecta*. *Dendrilla cactus* (Selenka) is a senior synonym of *D. rosea* Lendenfeld. The composition of this collection is even, with respect to the known demosponge fauna of Victoria and Tasmania. Its zoogeographic affinity is essentially Indo-West Pacific and relictic Tethyan, its provincial endemism high, and its overlap with the Antarctic/Subantarctic fauna almost nil.

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Introduction

In the initial stages of research on taxonomy, ecology and zoogeography of sponges inhabiting the continental shelf of southern Australia, at the Museum of Victoria (Melbourne, 1981–1985), it became apparent that the basis for meaningful taxonomic work was very tenuous. The quality of most published records of Australian species is inadequate for confident identifications, and the lack of illustrations and type data is almost general. For demosponges of the Maugean and Peronian provinces (Knox, 1960; defined for littoral faunas of Victoria/Tasmania and New South Wales, respectively, here extended to the sublittoral fauna), in particular, the primary literature on alpha-taxonomy dates mostly from before 1900 (Carter, 1885–1887; Dendy, 1895–1897; Hyatt, 1877; Lamarck, 1813–1815; Lendenfeld, 1887a, 1888, 1889b; Marshall, 1880; Polejaeff, 1884b; Ridley and Dendy, 1887; Selenka, 1867; Sollas, 1888). It is not only inadequate for identification, but its nomenclature (generic allocations) and synonymies are badly out of date.

Subsequent revisions, some with redescrptions and illustrations chiefly of Lendenfeld's work (Bergquist, 1980b; Burton, 1924a, b, 1927a, 1934a; Hallmann, 1912, 1914a–c, 1916a, b, 1917a, b, 1920; de Laubenfels, 1936a, 1948; Shaw, 1927a; Topsent, 1930a, 1932a, 1933; Vosmaer, 1911; Whitelegge, 1901–1907) alleviated the situation only in part, and often brought new problems (especially with de Laubenfels). Besides these major revisions of demosponges of southern Australia, many isolated revisions and relevant information (particularly re-examination of type specimens) are scattered in synonymies, discussions and footnotes, often in extralimital literature. In any case, constant evolution

in concepts of genera and families, by authors unfamiliar with the southern Australian fauna (except, after 1920, Bergquist, Burton, Dendy, Lévi et al., Topsent) has largely failed to incorporate this important fauna.

To bring the literature up to date an annotated bibliography and checklist of marine sponges of Australia has been compiled (Wiedenmayer et al., in press). The *Bibliography* contains 1520 annotated references. The *Checklist*, which also covers Australia's overseas coasts and adjacent waters (Antarctica between 45°E and 160°E, including the French Adélie Coast; Heard and Macquarie Islands; Christmas Island) includes 1173 valid species in 316 valid genera (993 species and 269 genera of Demospongiae). The *Checklist* is based chiefly on a survey of the literature, but includes some revisions based on type collections in Sydney, London, and East Germany.

The form of this report was dictated largely by two constraints: (1) The aims of the research project, as originally formulated, and (2) time and availability of assistance with work in the laboratory. A modern and thorough reappraisal, in publications, of the sponge fauna of the Maugean province, even without the relatively well known Calcarea (about 90 species recorded), would involve, in my estimate, at least 20 years of full-time work by a qualified taxonomist, under the best circumstances. On the basis of data in Wiedenmayer et al. (in press) and of extrapolation from the number of new species and new records in this report I estimate that the number of species of demosponges inhabiting the Maugean province is about 500.

It might have been preferable, for piecemeal coverage of the whole demosponge fauna, to pro-

ceed by families or orders. But various circumstances (the author having started as a newcomer to the Australian sponge fauna; the state of previous knowledge outlined above; lack of a complete set of micro-slides for the c. 1400 specimens from this province in the Museum of Victoria) suggested the present form as the only realistic one. Thus, a selection was made of newly collected specimens from localities roughly aligned in a transect through northern Bass Strait (text-fig. 1). This had the advantage that important field notes on fresh specimens, particularly on colour, could be included in the descriptions.

As Table 4 shows, the selection of material for description in this report is fairly representative of this province. The most conspicuous gaps, in terms of the relative importance of families and genera missed, are in the Suberitidae, Clionidae, Desmacellidae, Halichondriidae, Hymeniacidonidae, Crellidae and Renieridae. The horny sponges are particularly well represented. The gaps are thought to reflect a very incomplete sampling of habitats.

Collections

The 151 specimens described in the following systematic account were collected by, or in the presence of the author. The collecting stations with

relevant data are indicated in the following list. Field notes were taken as soon as practicable upon collection, but were sometimes delayed by sorting of large volumes of sponges in dredge samples. Colour photographs (Kodachrome) were taken of all specimens, and, whenever possible, notes on colour using the Munsell Charts (edition for use with plant tissues). Specimens were preserved in 10% formalin/seawater solution buffered with hexamine (as described in Rützler, 1978), and later transferred to 70% alcohol at the Museum of Victoria. Rützler's method was also used for preparing spicule mounts and microslides with hand-sections.

List of collecting stations

Text-figs 1, 2

Tasmania, Kent Group (39°29'S, 147°20'E) between Wilsons Promontory and Flinders Island. All specimens collected by divers (SCUBA).

KG 1. 23 Mar 1981, Erith Island, West Cove, wreck of S.S. "Bullseye". Sponges among dense algal growth on hull, depth 10–12 m. — *Jaspis stellifera*, *Tethya ingalli*, *Rhaphoxya felina*, *Echinoclathria laminaefavosa*, *Mycale* (*Arenochalina*) *mirabilis*, *Ectyodoryx maculata*, *Callyspongia pergamentacea*, *Amphimedon* sp., *Gelliodes*

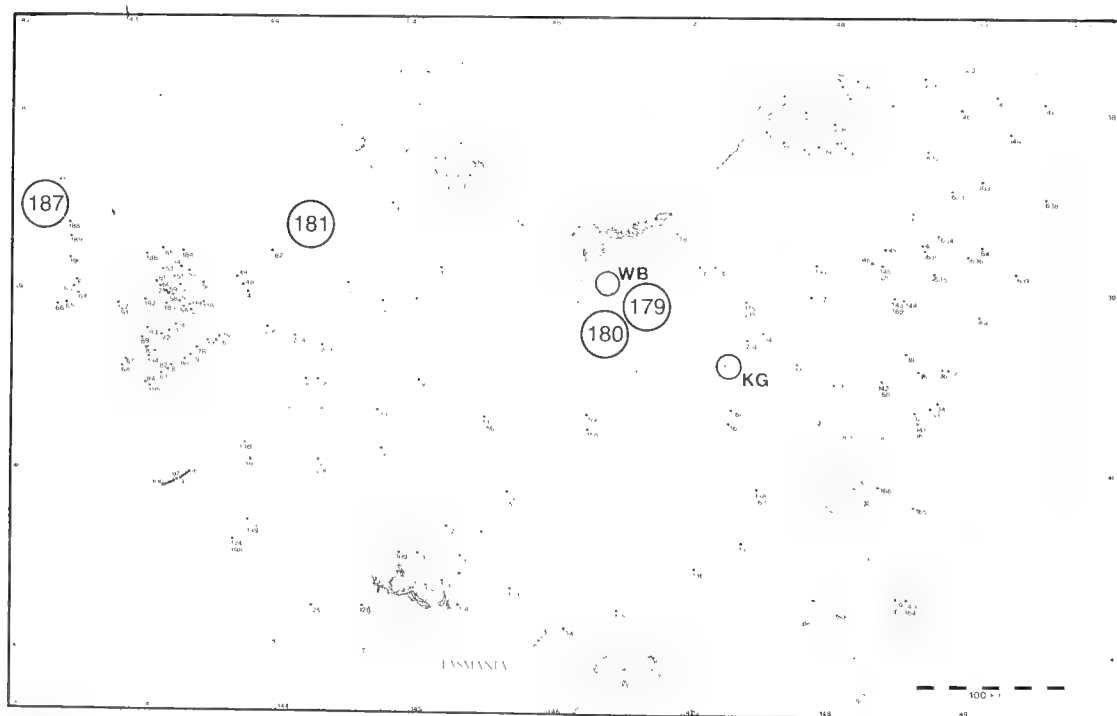


Figure 1. Map of Bass Strait with stations of the Museum of Victoria Bass Strait Survey sampled in 1979–83. The localities, from which the material described below has been obtained, are circled. The Kent Group, with stations KG 1–10, is represented in detail in Figure 2.

incrustans, *Clathrina* sp., *Aulorrhiza procumbens*, *Sycon* sp.

KG 2. 24 Mar 1981, Deal Island, Squally Cove (E of lighthouse). Slope with granite outcrops and boulders to 10 m depth, algal forest, large ascidians *Herdmania*, urchins, some encrusting corals *Plesiastrea*, solitary corals *Scolymia*.—*Geodia* (*Geodia*) *punctata*, *Psammoclema nodosum*, *Tedania anhelans*, *Reniera* sp., *Fasciospongia rimosa*, *Dendrilla cactus*.

KG 3. 24 Mar 1981, Deal Island, East Cove, W of jetty of settlement, some distance from shore. Outcrops and boulders, habitat similar to KG 2.—*Latrunculia hallmanni*, *Psammoclema vansoesti*, *Carteriospongia caliciformis*, *Leiosella levis*.

KG 4. 24 Mar 1981, Erith Island, West Cove, S of KG 1. Boulders covered with algae, much kelp.—*Latrunculia hallmanni*, *Echinoclathria globosa*, *Tedania anhelans*, *Coscinoderma pesleonis*, *Dysidea avara*, *Aplysilla rosea*, *Darwinella gardineri*, *Leucetta microrhaphis*.

KG 5. 25 Mar 1981, Garden Cove, N side of Deal Island. Habitat similar to KG 2–4.—*Ancorina robusta*, *Jaspis stellifera*, *Latrunculia hallmanni*, *Clathria wilsoni*, *Echinoclathria laminaefavosa*, *Ircinia caliculata*, *Thorecta tuberculatus*, *Aplysina lendenfeldi*, *Druinella rotunda*, *Aulorrhiza procumbens*, *Sycon* sp.

KG 6. 26 Mar 1981, Winter Cove, E side of Deal Island. Habitat similar to KG 2–5. Depth 3–6 m.—*Ancorina repens*, *Ancorina robusta*, *Ancorina suina*, *Rhabdastrella cordata*, *Rhabdastrella intermedia*, *Jaspis stellifera*, *Latrunculia conulosa*, *Echinoclathria leporina*, *Echinoclathria egea*, *Echinoclathria tubulosa*, *Phoriospongia argentea*, *Phoriospongia kirki*, *Psammoclema callosum*, *Psammoclema vansoesti*, *Tedania anhelans*, *Forcepia biceps*, *Coscinoderma pesleonis*, *Leiosella caliculata*, *Thorecta tuberculatus*, *Dysidea avara*.

KG 7. 26 Mar 1981, North Point (rocky promontory) of East Cove, Deal Island, depth 25–30 m, rock face below algal forest. Sponges, ascidians and

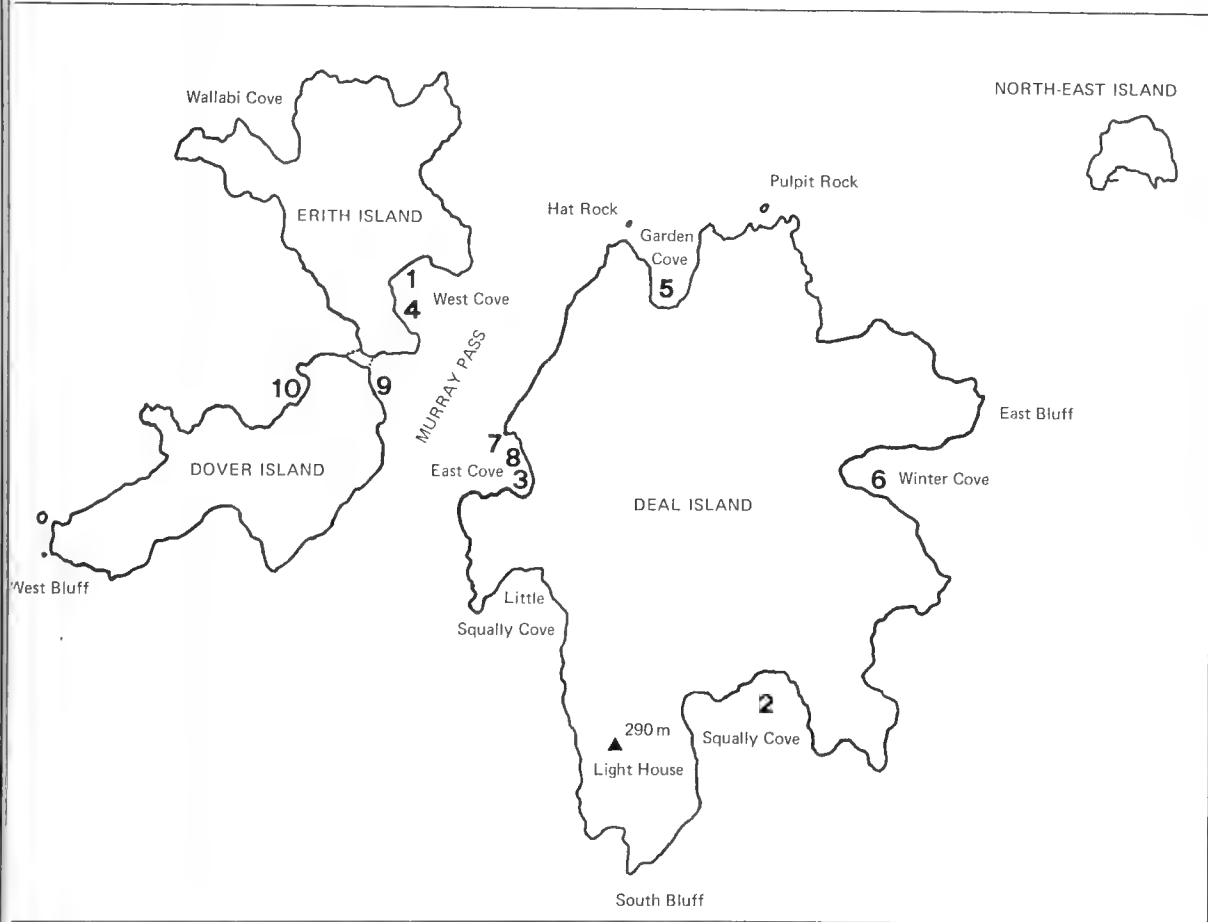


Figure 2. The Kent Group of islands, with stations KG 1–10.

gorgonians dominate. Some specimens from adjoining sloping sand.—*Polymastia crassa*, *Latrunculia conulosa*, *Trachycladus laevispirulifer*, *Clathria transiens*, *Echinoclathria leporina*, *Psammoclema ramosum*, *Mycale* (*Arenochalina*) *mirabilis*, *Ectyodoryx maculata*, *Spongia hispida*, *Thorecta glomeratus*, *Thorecta tuberculatus*, *Darwinella gardineri*, *Dendrilla cactus*, *Aplysina lendenfeldi*.

KG 8. 26 Mar 1981, East Cove, Deal Island, half-way between jetty and North Point. Rocky level bottom. Large sponges.—*Ancorina geodides*, *Latrunculia hallmanni*.

KG 9. 27 Mar 1981, E side of low-tide isthmus between Erith and Dover Islands ("Swashway"). Habitat similar to KG 2–6.—*Clathriodendron cacticutis*, *Echinoclathria carteri*, *Callyspongia bilamellata*, *Callyspongia serpentina*, *Thorecta choanoides*.

KG 10. 27 Mar 1981, W side of Dover Island, cove SW of isthmus. (a) Granite boulders with algal forest, depth 10 m.—*Spirastrella papillosa*. (b) Submerged cave, depth c. 5 m.

Wilsons Promontory, Waterloo Bay.

WB 28. 28 Mar 1981. Cliffs, vertical faces, cave, depth 12 m, collected by divers.—*Corticum candelabrum*, *Polymastia crassa*, *Echinoclathria favus*, *Carteriospongia silicata*.

BSS 179. 18 Nov 1981. 39°03.2'S, 146°39.5'E (20 km E of Station WB) depth 55 m, bottom muddy sand.—*Phoriospongia carcinophila*, *Psammoclema bitextum*, *Psammoclema densum*, *Callyspongia toxifera*.

BSS 180. 18 Nov 1981. 39°12.9'S, 146°27.3'E (7 km S of Wilsons Promontory), depth 65 m, bottom muddy sand, sand and shells, fine algae.—*Callyspongia ramosa*, *Carteriospongia* cf. *vermicularis*, *Darwinella australiensis*, *Darwinella gardineri*.

BSS 181. 19 Nov 1981. 38°39.8'S, 144°18.2'E (30 km SE of Lorne), depth 79 m, bottom very fine sand with many branching, parchment-like worm tubes (Chaetopteridae), on which most sponges collected are encrusting or attached.—*Strongylacidon stelliderma*, *Stylotella inaequalis*, *Phoriospongia carcinophila*, *Psammoclema densum*, *Psammoclema goniodes*, *Tedania anhelans*, *Lissodendoryx isodictyalis*, *Phorbas* cf. *tenacior*, *Callyspongia toxifera*, *Darwinella australiensis*.

BSS 187. 20 Nov 1981. 38°32.0'S, 142°28.6'E (17 km S of Warrnambool), depth 52 m, bottom coarse sand and shells.—*Ancorina robusta*, *Tetilla praecipua*, *Spirastrella papillosa*, *Chondrosia reticulata*, *Pseudaxinella decipiens*, *Reniochalina sectilis*, *Rhaphoxya cactiformis*, *Phoriospongia*

kirki, *Psammoclema fissuratum*, *Psammoclema goniodes*, *Psammoclema radiatum*, *Psammoclema stipitatum*, *Callyspongia asparagus*, *Callyspongia diffusa*, *Callyspongia persculpta*, *Oceanapia putridosa*, *Spongia hispida*, *Coscinoderma pes-leonis*, *Aplysina ianthelliformis*, *Pseudoceratina durissima*.

Taxonomic procedure

There is now a discrepancy, in several points, between the formal, "monographic" style of this report, and its provisional nature (as the "first instalment" of a continuing project), a discrepancy that might easily mislead newcomers to accept all parts of the systematic section (identification, synonymies, diagnoses, descriptions, discussions) as "definitive" for some time to come. This proclivity is conditioned by the particular situation in southern Australia (as outlined above), where a desolate, stagnant state, since the turn of the century, is suddenly improved by a major effort. A qualification of all these points is therefore in order.

1. Higher taxa. The reviewers of the first version of this systematic account have justly criticised the lack or deficiency of this sort of material (diagnoses and discussions of families and genera, keys to genera with several described species). A part of this problem resides in Wiedenmayer et al. (in press) which I had hoped might be published now providing a complement in some of these respects. Its publication seems to be delayed.

Diagnoses and discussions of families. Diagnoses are included in Wiedenmayer et al. (in press). I have preferred not to repeat them here, which means that, for this purpose, I mostly adhere to the definitions given by Lévi (1973), Bergquist (1978, 1980b), van Soest (1980, 1984), and Hartman (1982). The family Desmacididae is revised, with the two subfamilies Desmacidinae (*Esperiopsidae* of authors) and *Stylotellinae*, the latter comprising the sandy genera *Phoriospongia* (*Chondropsis* and *Psammascus* of authors), and *Psammoclema* (= *Psammopemma*). Lengthy discussions are provided for the *Latrunculiidae* and for the *Myxillinae* in the *Tedaniidae* (here chiefly regarding *Lissodendoryx*). Several families in the *Axinellida*, and *Poecilosclerida* (particularly the *Microcionidae*), and genera in the *Dictyoceratida* (particularly *Phyllospongia*/*Carteriospongia*, and *Coscinoderma*) need to be reappraised. But these happen to be poorly represented in the material here covered, and such revisions are better undertaken in special studies by my colleagues in northern Australia.

Synonymies and diagnoses of genera. Some diagnoses are quoted from previous accounts by other

authors unchanged, some with additions, others with alterations, and some are new. The variable lengths tend to reflect the degree of difficulty at this level. As a guide to the evolving concept of genera, I have adopted annotated synonymies similar in style to those used by me earlier (Wiedenmayer, 1977a).

Unavailable and unused names of the genus- and species-groups (nomina nuda, nomina vana, nomina nulla, nomina oblita, and junior primary homonyms) are cited in square brackets. Such Latin terms for name categories denoting criteria of validity and availability, are used and defined in volumes of the *Treatise of Invertebrate Paleontology* (see Loeblich and Tappan, 1964). Definitions of these terms are found again in the glossary below. They are more amply defined and discussed, with respect to Porifera, in Wiedenmayer et al. (in press). In rewriting generic diagnoses, I often felt that old ones simply did not work with fresh material, and that a modification or two in such diagnoses (and an occasional merger of genera) were more sensible than trying to explain a "bad fit" or ambivalence of a little known or new species under "Remarks" following its description. It should be considered that more time for collecting in the same localities here covered would probably have produced dozens of other records, including sibling species of those described, which might in turn necessitate further changes in generic diagnoses. With only one-seventh of the estimated total provincial demosponge fauna covered in this report, such speculations are legitimate.

Keys. These were suggested by the reviewers particularly for *Echinoclathria*, *Psammoclema*, and *Callyspongia*. Keys are problematical for sponges, mostly because, unlike other invertebrates, they are so difficult to put consistently into a hierarchic framework, also because keys tend to mask the enormous differences in degree of variability, and because several important regional faunas are too poorly known for confidence (e.g., eastern tropical Pacific, South Atlantic, southern Australia). Keys for sponges have to rely only or chiefly on microscopical, skeletal traits, especially spicule morphology. They are therefore of little if any use to general biologists, who are not used, or unwilling, to prepare two kinds of mounts in Canada balsam for every specimen (thick sections and dissociated spicule mounts). Sandy sponges constitute a special problem, because "teased" or sieved mounts are often necessary. Nevertheless, keys are desirable for newcomers to the sponge fauna of southern Australia, particularly those with previous experience in sponge taxonomy; but not at this

stage. They would contradict the preliminary nature of this report, by contributing essentially to a false impression of definitiveness. It is imperative that a reasonably complete sampling of the local fauna is worked up, whenever possible with more than one specimen per species, before keys are meaningful here. I am convinced that many more new species and records of Stylotellinae, Microcionidae (particularly *Echinoclathria*), and Callyspongiidae will eventually emerge in southern Australia. In this context, all relevant type slides in the AM, BMNH and ZMB will have to be evaluated, which I could not do.

Type species. All relevant information is in Wiedenmayer et al. (in press). In some cases with errors and misunderstandings, clarification are here added under Remarks following generic diagnoses.

2. Species.

Identifications and synonymies. Some synonymies are extremely long, and have as such raised doubts with the reviewers. There are two kinds of such synonymies: (1) Those of cosmopolitan or widely disjunct species, headed as "Selected synonymies" (I have avoided "restricted synonymy", as used by others, because this might imply a deliberate confinement and revision with respect to earlier synonymies, while I give a broad sampling, including cross-references), and (2) those of polymorphic Australian or austral species, in which most synonyms are names of Lendenfeld.

In the first case, the doubts as to the reality of extremely wide distribution (as in *Corticium candelabrum*, *Tedania anhelans*, *Lissodendoryx isodictyalis*, *Dysidea avara*, *Aplysilla rosea*, *Darwinella australiensis*, *D. gardineri*) are probably tinted by an exclusively actualistic outlook, by comparisons with biogeography of higher, more stenotopic invertebrates, and by the argument that morphological characteristics in such species are too vague and variable, and therefore mask "real" biological differences. As long as such "differences" are not unequivocally demonstrated, it seems more sensible to regard such populations as conspecific, if not panmictic, and not to use open nomenclature or even new species names for such austral records. It is quite plausible that those constitute relics of late Tethyan distribution, more so than I argued earlier (Wiedenmayer, 1974, 1977a). The disjunct Brazilian/ Central Atlantic/ South Atlantic/ Indian Ocean/ austral distribution of some stenotopic elements has palaeobiogeographic roots (e.g., the species *Callyspongia pergamentacea* and the sibling pair *Aplysina lendenfeldi*/*A. pedunculata* in this report; *Tedania commixta* fide Topsent (1904);

Hymedesmia mertoni Hentschel, 1912, fide Boury-Esnault and Lopes (1985); *Asteropus simplex*, *Tethya japonica*, and three species of *Phoriospongia* (as *Psammochela* and *Psammotoxa*), fide Boury-Esnault (1973); further species are quoted by Hechtel, 1976: 249).

The annotations in these synonymies will serve as guides and aids to future revisions and evaluation of new records, and thus to better diagnoses, by pointing out the more relevant informations and their nature. Unfortunately, many published records of such species, especially from the type province, lack supplementary information on morphology, which is probably due to the assumption that they are sufficiently known from earlier descriptions.

In the second case, I have been criticised for relying excessively on Burton's revisions, which are notorious for supposedly indiscriminate lumping. This argument is far too generalised. Burton sometimes erred in the opposite direction (see my comment on *Lissodendoryx ternatensis*, *L. sinensis*, and *L. similis*). Even in his most criticised exercise in lumping, his revision of all *Calcarea* (Burton, 1963), the extensive mergers of species and genera are largely theoretical, without loss to practice. In effect, all previously accepted species and records are carefully redefined as "named forms" and synonyms, on the basis of re-examination of primary and secondary types (including slides), for which a detailed list is given as an appendix. The same painstaking procedure, though less well documented in print, characterised the revisions of most of Lendenfeld's (1887a) "Chalineae" by Burton (1927a, 1934a).

Anyone thoroughly acquainted with Lendenfeld's Australian type material (of which I have seen virtually every specimen in the AM and BMNH) and with his idiosyncratic and faulty methods criticised chiefly by Whitelegge and Dendy (Wiedenmayer et al., in press) will have come to similar conclusions regarding his extreme proclivity for splitting, and his negligence in observing and/or describing microscopical features (though he could, at times, be accurate). A striking, hitherto unrevised example of such negligence is *Chalinula coxi* Lendenfeld (1885c), a junior synonym of the chiefly estuarine *Tetilla dactyloidea* (Carter), of wide Indo-Pacific distribution.

With some of my synonymies involved (*Echinoclathria laminaefavosa*, *Phoriospongia kirki*, *Spongia hispida*), it is already clear from Lendenfeld's descriptions, that his distinctions do not hold up to modern taxonomic standards. In the case of *Callyspongia diffusa*, *C. pergamentacea*,

C. ramosa, *C. serpentina*, all polymorphic and superficially often similar, I gained sufficient confidence from examining the type specimens; but the ultimate control, with slides, had to be foreclosed due to lack of time (as with all other type material listed as examined). I therefore headed these synonymies as "provisional", preferring not to mark all entries with question marks indiscriminately, masking the really doubtful synonyms, of which I was unable to see type material.

In these cases, the annotations with most references should be helpful to future revisers, allowing for rapid sorting out of old and new records, redescrptions, type status, etc, especially in connection with Wiedenmayer et al. (in press).

Diagnoses. These were added, somewhat reluctantly, at the suggestion of the reviewers and of the editor. The provisional nature of this report is especially conflicting with its style in the apparent consistency of these diagnoses. The most reliable ones will probably be those for endemic, stenotopic species represented by several specimens in the collection, and described previously. The least reliable will be those for new species, and new records of rare species, with only one specimen in the collection. Diagnoses for eurytopic and polymorphic species (frequently parallel qualities, as with other invertebrates), and those for cosmopolitan species, are, by nature, longer and more likely to need updating in details. The latter are obviously based chiefly on various published sources, and will (especially with *Tedania anhelans* and *Lissodendoryx isodictyalis*) cover a broader spectrum than is likely to be encountered in records from southern Australia.

Descriptions. Many of these may be criticised as being too long and detailed. They can, however, be justified with the excessive brevity of most of Carter's and Dendy's descriptions for this area, the often misleading nature of Lendenfeld's, the richness of this fauna, and the presence of many sibling groups. Other siblings of species here described are known to occur in the area only through early descriptions (see *Remarks* following descriptions, and Wiedenmayer et al., in press), and remain to be recollected and redescrbed. Especially with sibling pairs with several specimens in the collection (as in *Latrunculia*), I preferred to err on the side of verbosity, rather than suppressing details, because so little is still known on local-intraspecific, biogeographical and ecological differentiation of morphological characters, particularly outside the best known provinces, such as the Western Mediterranean. Details, which might seem trivial now, may someday be evaluated in a different perspective.

Supplementary information. Data on distribution are incorporated into the annotated synonymies. Synopses of world-wide distribution, by provinces and localities for Australia, by regions elsewhere, and depth ranges are in Wiedenmayer et al. (in press).

Other material examined. Virtually all Australian type specimens and hypotypes relevant to this report of the following authors and publications could be examined: Lendenfeld (1885f, h; 1886a, e, f; 1887a, 1888, 1889b) in Sydney (AM) and London (BMNH); Carter (1885a–1886h, 1887a, ex J.B. Wilson collection; 1879b, 1881b, 1882a, 1883b, c, mostly ex Bowerbank collection; all in BMNH); Dendy (1895–1897, NMV); Bowerbank (1844b, 1872, 1873a; BMNH); Gray (1843, BMNH); Burton (1934a, BMNH); Whitelegge and Hallmann (AM); Marshall (1880, PMJ and ZMB); some relevant ones of Polejaeff (1884b, BMNH), Ridley and Dendy (1887, BMNH), Ridley (1884a–c, BMNH), Kirkpatrick (1903b, BMNH), Shaw (1927a, BMNH), Sollas (1888, BMNH). At the time of my survey of these type collections (AM in 1982; BMNH, PMJ and ZMB in 1983), which also included species and papers not covered in this report, most specimens were photographed. The negatives and prints are now kept in the Museum of Victoria Sponge Archive (Department of Invertebrate Zoology). Some of these are here reproduced in the plates (pl. 2 figs 6, 9; pl. 3 figs 2–6; pl. 4 figs 2–5, 7–12; pl. 5 figs 1–3; pl. 6 figs 4–7, 11; pl. 7 figs 4–7, 10, 11; pl. 8 figs 4, 8–11; pl. 9 figs 4–6, 13; pl. 10 figs 4–7, 10, 11; pl. 11 figs 1, 2, 7, 9, 10; pl. 12 figs 2, 3, 11, 12; pl. 13 figs 2, 3, 6, 7, 11, 12; pl. 14 figs 1–5, 10; pl. 15 figs 1–5, 7, 10; pl. 16 figs 2, 3, 6, 7; pl. 17 figs 2, 8). Unfortunately, various circumstances prevented me from examining the type slides involved in the AM, BMNH, and ZMB.

The indications for each species, under the heading *Material examined*, following the new material, now contain only valid species names and synonyms in original combination, and usually type status. Other details (number of specimens, register numbers, reference to film/frame numbers in the Museum of Victoria Sponge (Photo) Archive) are found in Wiedenmayer et al. (in press). The type specimens in East-Berlin (ZMB) were not available for study at the time of my visit there, with two exceptions: the holotypes of *Phoriospongia reticulatum* Marshall (pl. 6 fig. 6; pl. 24 fig. 3) and of *Psammopemma densum* Marshall (p. 8 fig. 4). One of Lendenfeld's slides from *Druinella rotunda* in

the same collection could be obtained for study (pl. 38 figs 1–5).

Terminology and glossary

Conventional morphological terms are mostly those explained in my illustrated glossary (Wiedenmayer, 1977a; 30–51). I have, in addition, used some terms which have been criticised as old-fashioned or otherwise rarely used. Some of these are revived from early descriptions (such as Carter's), from time when spongologists were also naturalists, publishing in several disciplines, and had no qualms about using terms borrowed from botany. I find these apt and implicitly descriptive for recurring features. Though most of these terms are defined in good standard English dictionaries, I often use them in a more restricted and special sense.

Alveolate. Finely honeycombed on surface; in choanosome, regularly cavernous, with round or rounded-polygonal interstices delimited by contorted trabeculae or walls.

Cancellate. Latticed at right angles, cross-barred.

Cerebroid. Brain-like pattern of the surface.

Clathrate. Latticed.

Concrescence. Lateral fusion, mostly of branches, lamellae, or tubes.

Crypts. Widespread interconnected vestibules between a thick, firm ectosome and the choanosome (subcortical), or within the inner portion of the ectosome (intracortical).

Dendritic-vermiculate. Wrinkles at the surface or subdermal canals have a continuously winding and branching course.

Diataxonic. Applies to synapomorphies in higher taxa, with accent on the uselessness of such characters in taxonomy.

Excrescence. Outgrowth.

Fenestrate. Riddled; perforated by similar small gaps.

Heteropolar. Denotes the general condition of unequally ended pseudasters and ornamented microrhabds (e.g., anisodiscorhabd).

Lacinules. Small, often compressed and prolific lobes or digitations sticking out from the surface.

Lacuna. Gap, window, conspicuous hole other than an oscule or pseudosculum.

Lipogastric. Devoid of atria.

Lithic. For incorporated fragments derived from rocks (through uptake from bottom sediment).

Moniliform. Shaped like a string of beads.

Nervures. Denotes the pattern, in the dermal membrane, of microscopic collagenous ribs or bands, often anastomosed, like the veins of a leaf.

Nomen correctum. Emendation of a *nomen imperfectum*.

Nomen dubium (*genus dubium*, *species dubia*). Name of unknown or doubtful application. Unrecognisably described species (type species) of which all type material is known to be lost, and for which the fixation of a neotype is inadvisable.

Nomen imperfectum. Valid name needing emendation (when not meeting ICZN, Articles 26–29, 31); particularly common with adjectival species epithets and names of higher taxa deficient in endings.

Nomen inquirendum (*genus inquirendum*, *species inquirenda*). Name of lower taxon of doubtful application on the basis of description(s), but of which type material (of type species) is known to be accessible for redescription.

Nomen negatum. Incorrect (unavailable) original spelling (ICZN Article 32c, d). Commonly applied to those alternative forms in multiple original spellings eliminated by fixation of the correct original spelling by the first reviser.

Nomen nullum. Incorrect subsequent spelling (ICZN Article 33c).

Nomen oblitum. Forgotten name. Cited only as “a descriptive term” in the glossary of the ICZN (3rd edition, 1985: 260), and replaced in the main text (Articles 23b, 79c) by “unused senior synonym.” See Declaration 43, 1970, *Bulletin of Zoological Nomenclature* 27: 135–163, and comment in Wiedenmayer (1977a: 52).

Nomen vanum. Unjustified emendation (ICZN Article 33 b(iii)).

Pedice, *peduncle*. A commonly small, short, stalk- or foot-like base.

Penicils. Brushes, especially of bundled or radiating megascleres, commonly not bound by spongin, flush at or projecting from the surface.

Polytylote. For megascleres having several annular swellings along their shaft. Frequent in styles/tylostyles of Poecilosclerida, also in some Hadromerida.

Rhaphidotaxon. An irregular, asymmetrical toxon, or irregularly sinuous rhabdite.

Rhizome. Root-like structure.

Rugo-reticulate. The folds or wrinkles affecting the surface are combined into a net-like pattern, with triangular, square, or polygonal depressed interstices.

Rugose. Of a surface provided with numerous wrinkles or folds (rugae).

Rugo-vermiculate. The folds or wrinkles of the surface are discontinuous and have a winding course.

Schizotype. Significant fragment or section of a type specimen. In 1977a, I attributed the term to W.D. Hartman. It was already used by Annandale (1915c: 469).

Spicular vicariance. The tendency, within some families and genera (particularly in the Desmacididae and Tedaniidae), for pairs of principal megasclere types (diactines/monactines, acanthose/smooth), which are consistently segregated in most other taxa, to pass from one state to the other, mostly mutually exclusive between genera or congeneric species, less often within populations, or mixed in variable proportions, with transitions (ambivalence). Spicular vicariance may be regarded as a special form of homology, but its phylogenetic significance (especially in Tedaniidae) is not clear.

Stipitate. Stalked.

Stolon. A single repent (trailing) branch.

Subtylote. Tylole with indistinct heads.

Sulci. Furrows.

Terete. Basically cylindrical, but commonly winding or crooked (when not applied to megascleres).

Trabecula. A choanosomal structural element in form of band or bar; an angular or compressed tract, fibre, or portion of matrix, without definite orientation.

Umbel. Term borrowed from botany, denoting the pattern of multiple branches radiating from the end of a stalk (ascending fibre) at variable angles, occasionally subdivided, and ending more or less in one plane. Here used for the peripheral skeleton of many Astrophorida and Hadromerida.

Vermiculate. Worm-like; winding but discontinuous.

Verrucose. With scattered wart-like elevations.

Size of specimens and its gradation

A gross subdivision into three categories is occasionally used in diagnoses and descriptions. In my experience with statistics (most frequent sizes) of Bahamian sponges (Wiedenmayer, 1977a, most tables in the systematic-descriptive part), the following subdivision seems appropriate (except for thinly encrusting forms):

Small. Up to 5 cm in greatest diameter (25 cm² greatest projected area).

Medium. Mostly in the order of first-size (100 cm²), up to 250 cm².

Large. Mostly in the order of head-size, and larger.

Abbreviations

AM, Australian Museum, Sydney.

BMNH, British Museum (Natural History), London.

F51927, example of identifier (NMV register number) for a new specimen described and, or figured.

ICZN, International Code of Zoological Nomenclature, third edition (1985).

Mybp, million years before present.

MJG, Landesmuseum Joanneum Graz (Austria), Abteilung für Zoologie.

MNHP, Muséum National d'Histoire Naturelle, Paris.

MZUS, Musée Zoologique de l'Université Louis Pasteur et de la Ville de Strasbourg, France.

NMV, Museum of Victoria, Division of Natural History (formerly National Museum of Victoria).

PMJ, Phyletisches Museum der Friedrich-Schiller-Universität, Sektion Biologie, Jena, GDR.

SMF, Natur-Museum Senckenberg, Frankfurt am Main, FRG.

ZMB, Museum für Naturkunde (Zoologisches Museum) der Humboldt-Universität, East Berlin, GDR.

ZMH, Zoologisches Museum der Universität, Hamburg, FRG.

2.5 YR 8/10, example of colour notation from the Munsell Colour Charts.

Italics in spicule measurements denote means.

Class Demospongiae Sollas, 1885

Subclass Homoscleromorpha Lévi, 1953

Order Homosclerophorida Dendy, 1905

Plakinidae Schulze, 1880

Corticium Schmidt

Corticium Schmidt, 1862: 42.—Lendenfeld, 1903: 121.—Thomas, 1970d: 260 (Indian Ocean records).—Pulitzer-Finali, 1983: 448, 602 (Mediterranean species).

Diagnosis. Plakinidae in which candelabra are usually present, without diactines. Microcalthrops may be simple or lophate (equally or irregularly).

Corticium candelabrum Schmidt

Plate 1 figure 1, plate 18 figure 1, text-figure 3

Selected synonymy.

Corticium candelabrum Schmidt, 1862: 42, pl. 3 fig. 25 (Adriatic Sea).—Lendenfeld, 1903: 122 (synonymy, diagnosis, distribution).—Burton, 1934a: 521 (synonymy, distribution; Great Barrier Reef).—Rützler, 1965: 15 (synonymy, ecology; Adriatic Sea).—Thomas, 1970d: 261 (India).—Boury-Esnault, 1971: 295 (ecology; western Mediterranean).—Pulitzer-Finali, 1972: 350 (colour, ecology; western Mediterranean).—Poulouen, 1972: 726, 746 (western Mediterranean).—Pulitzer-Finali, 1983: 448 (ecology, colour; western Mediterranean).

Material examined. Station KG 10b, three specimens (F51927); station WB, one specimen (F51928).

Diagnosis. Small, compressed-lobate, light brown; firmly rubbery, smooth, slippery. Oscules marginal. Choanosome dense, with abundant scattered

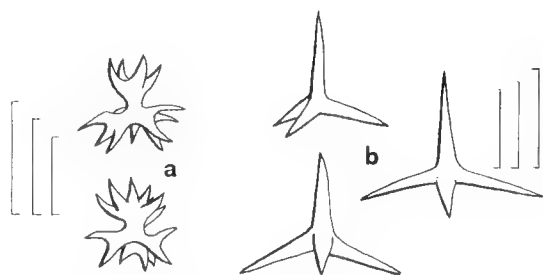


Figure 3. *Corticium candelabrum*, spicules, $\times 320$. a. Candelabra, with range and mean of height. b. Microcalthrops, with range and mean of ray lengths.

candelabra, less frequent simple microcalthrops. Spicules packed below surface.

Description. Small compressed lobes with rounded margins, sometimes coalescent, with irregular folds; 2 specimens ear-shaped and -sized. In life light brown (2.5 YR 8–9/4–8) with tinge of orange in F51928 (2.5 YR 6–8/8). Firmly rubbery, smooth, slippery. Ostia regularly scattered on both faces; oscules on and near margins.

Atria and excurrent canals in mesial region; incurrent canals regularly parallel and radial.

Spicules packed in cortical region (250–500 μm thick); mostly scattered in choanosome, frequently aligned and more crowded along incurrent canals; packed around excurrent canals. Microcalthrops less frequent than candelabra; relatively rare in F51927, more frequent in F51928.

Spicule measurements (F51927): length of rays in microcalthrops, 28.5–32–38.2 μm ; height of candelabra: 27.1–36.1–42.1 μm . Few smaller, developmental forms and malformations occur.

Remarks. The other species of *Corticium* known from Australia, *C. simplex* Lendenfeld (1907a) from the North-West Shelf, is described as having candelabra only and a peculiar vesicular structure of cortex and parts of the choanosome. A specimen from the Northern Territory shown to me by J.N.A. Hooper (Darwin) agrees in vesicular structure of cortex and parts of the choanosome but contains simple microcalthrops. The other three Mediterranean species known, *C. bowerbanki* Sarà, *C. topsenti* Poulouen, and *C. reductum* Pulitzer-Finali (see Pulitzer-Finali, 1983: 449) have more complex microcalthrops, and so has *C. acanthastrum* Thomas, 1970d, from India.

Burton's material of *C. candelabrum* from the Great Barrier Reef came from an open-marine environment (presumably level bottom), 25–30 m depth. It is interesting to note that our material came from submerged caves, like many of the Mediterranean records.

In Mediterranean specimens, ray lengths of microcalthrops are given as 30–40 μm , maximum diameter (height) of candelabra as 27–32 μm (Lendenfeld, Pulitzer-Finali). Lendenfeld's description (1903) does not significantly depart from mine, nor can I see any sensible discrepancies in published figures of spicules of Mediterranean specimens.

The disjunct distribution of *C. candelabrum* is gestured by the presence of candelabra very similar to Recent examples in the Upper Eocene–Lower Tertiary to Recent examples in the Upper Eocene–Lower Oligocene Oamaru Diatomite of New Zealand (Hinde and Holmes, 1892, pl. 12 figs 12–15). Furthermore, simple and lophate, regular and irregular fossil microcalthrops (same plate) make it virtually certain that the *candelabrum* and *bowerbanki* groups were already differentiated then within *Corticium*. As will be shown in the concluding chapter, the Oamaru fauna lived in shallow, warm water, contrary to previous opinions (including mine), and the associated Foraminifera point to immigration from the tropical Indo-West-Pacific region along the Papuan Geosyncline, during a period of exceptional warming at higher latitudes. A centre of origin of *Corticium* in the Indo-West-Pacific region is not likely, however. According to Hinde and Holmes (1892: 228), candelabra are already known from the (Upper) Jurassic of Poland. The genus may therefore have originated in the western Tethys and may have been affected by later radiation in the eastern Tethys or early Indian Ocean. As is the rule with long-lived, widely distributed genera, *Corticium* was and is probably more eurytopic than Mediterranean records suggest (where dominance of inclined and recessed rocky sublittoral substrates resulted from the particular Late Neogene tectonic setting of this region), though it may always have preferred shallow water.

Subclass Tetractinomorpha Lévi, 1953

Order Astrophorida Sollas, 1887

Ancorinidae Schmidt, 1870

Synonym: Stellettidae Carter, 1875

Ancorina Schmidt

Ancorina Schmidt, 1862: 51. — Dendy, 1924: 296 (synonymised with *Ecionemia*). — Wilson, 1925: 286 (résumé). — Topsent, 1928: 35. — Bergquist, 1965: 189 (synonymised with *Ecionemia*). — Bergquist, 1968: 32 (synonymised with *Ecionemia*). — Lévi (in Brien et al., 1973): 595 (retained as distinct genus).

Ecionemia Bowerbank, 1863c: 1101. — Thiele, 1900: 28. — Lendenfeld, 1903: 61 (as subgenus of *Ancorina*). — Dendy, 1905: 79. — Wilson, 1925: 296 (résumé, discussion, probably a synonym of *Ancorina*). — Lévi (in Brien et al., 1973): 595 (retained as distinct genus).

Stellettinopsis Carter, 1879b: 348. — Bergquist, 1965: 189. — Bergquist, 1968: 32.

Psammastra Sollas, 1886: 194. — Sollas, 1888: cxli, 174. — Thiele, 1900: 36. — Dendy, 1905: 80.

Algol Sollas, 1888: cxli, 200 (objective synonym of *Stellettinopsis*). — Bergquist, 1965: 189.

Thalassomora Lendenfeld, 1888: 40. — Lendenfeld, 1903: 62 (synonymised with *Ecionemia*).

Sanidastrella Topsent, 1892c: xviii. — Lendenfeld, 1903: 58 (as subgenus of *Ancorina*). — Lévi (in Brien et al., synonymised with (*Ancorina*)).

Diagnosis. Ancorinidae with microrhabds or sanidasters in addition to euasters. Microrhabds commonly minutely spined or roughened, forming a dermal layer. Euasters may comprise oxyasters.

Remarks. Many authors have distinguished *Ancorina* and *Ecionemia* on the grounds of cortical sanidasters in the former, cortical roughened microrhabds in the latter. I agree with Dendy (1916a: 239; 1924: 296) and Bergquist (1968: 32, 33) that this difference is insignificant. Lévi (in Brien et al., 1973: 595) grants this basic similarity but uses (like Lendenfeld, 1903) presence/absence of oxyasters as diagnostic criterion. Considering the variability and diversity of choanosomal euasters in Astrophorida, this criterion seems irrelevant (Wilson, 1925: 297). The diagnosis is here revised accordingly.

Ancorina geodides (Carter)

Plate 1 figure 2, plate 18 figures 2–3, text-figure 4

Stelletta geodides Carter, 1886b: 125 (Port Phillip Heads).

Psammastra geodides. — Sollas, 1888: 200 (redescription, discussion).

Ancorina (*Sanidastrella*) *geodides*. — Lendenfeld, 1903: 60 (résumé).

Stelletta geodides. — Dendy, 1905: 80 (discussion).

Material examined. Station KG 8, one specimen (F51929), only a segment kept. Sketch by Carter, in his Manuscript Catalogue (BMNH). Unpublished specimen from Maria Island, Tasmania, BMNH 1925.11.1.1315 = RN XVIII (wet), identified by Dendy as *Ancorina geodides*.

Diagnosis. Massive, cake-to dome-shaped, hard. Surface dark grey to black, may be faintly tuberculate, with minute acanthomicrorhabds; oscules inconspicuous. Thick cortex detachable, internally light grey. Choanosome dense, buff.

Description. massive, 15–20 cm in diameter, cake-to dome-shaped. Lower half encrusted by platelets of coralline alga. Externally very dark brown to black (5YR 1/3–4), also in alcohol.

Hard. Surface smooth in life, now finely rugose and microtuberculate with low magnification.

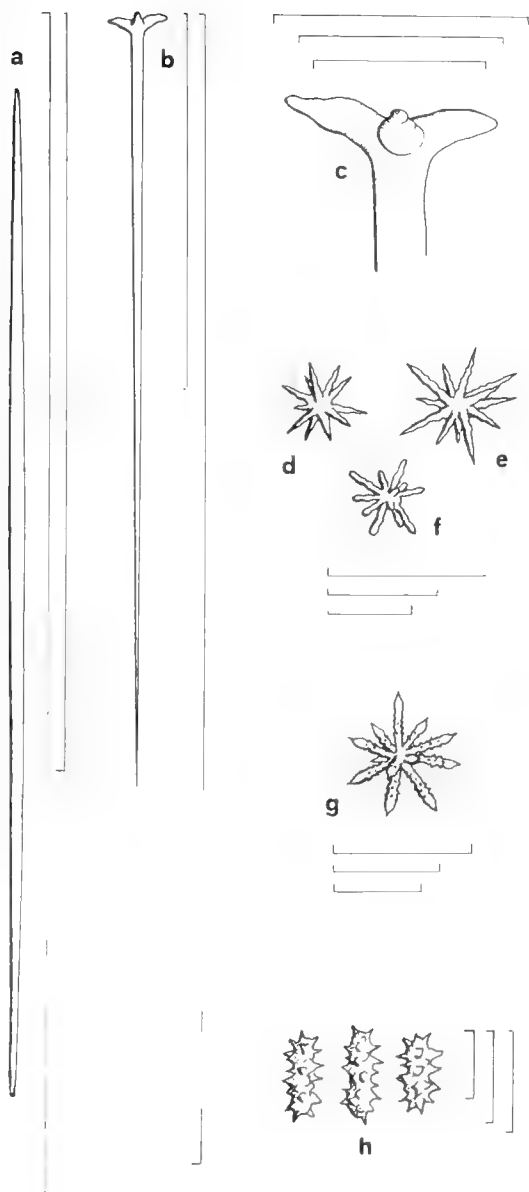


Figure 4. *Ancorina geodides*, spicules. As with all following figures of spicules, ranges (minimum, usually mean, and maximum dimensions) are indicated with separate scales for each category. a. Oxea (with example of mean length), $\times 68$. b-c. Orthotriaenes, $\times 68$, with clade enlarged, $\times 263$. d-f. Choanosomal oxyasters and strongylaster, $\times 790$. g. Cortical asters with lanceolate ray-tips, $\times 790$. h. Acanthomicrorhabds, $\times 1450$.

Oscules inconspicuous, 0.2–0.3 mm in diameter, round to elongate, irregularly scattered, some clustered.

Choanosome dense, buff-coloured (5 YR 7/6–8 to 5 YR 8–9/4), criss-crossed by excurrent canals 1–2 mm wide. Cortex is 2–3 mm thick, of 2 distinct layers, the outer almost black, the inner light

yellowish grey (7.5 YR 9/1–4); easily detachable, with continuous zone of subcortical crypts. Inner cortex coarsely fibrous (collagenous), traversed by radial chones. Chones about 270 μm wide, regularly spaced 0.7–1.5 mm, communicating with subcortical crypts, with sphincter somewhat below top of inner cortex. Lining of chones similar to outer cortex and to choanosome with many strongylasters and acanthomicrorhabds, usually in clusters. Acanthomicrorhabds scattered in fibrous cortex; asters rare here.

Outer cortex strongly pigmented, about 500 μm thick; with many strongylasters, and, in outermost portion, crowded acanthomicrorhabds.

Choanosomal skeleton comprises megascleres mostly radially arranged, with cladomes of triaenes staggered in narrow zone below subcortical crypts. Deeper parts more confused, with many megascleres at various angles, singly and in bundles. Bundles traverse peripheral choanosome and cortex, usually expanding slightly in inner cortex forming narrow penicils ending at surface. Choanosomal aster, regularly scattered interstitially, numerous.

Spiculation: (1) Oxea straight, mostly fusiform 1334–1773–2080 \times 12.1–21–27.7 μm ; (2) orthotriaenes with small, often irregular cladomes (clads may be crooked, reduced, suppressed or follow slightly different angles), rhabds 662–1350–2026 \times 9.5–21–26 μm , clads 39–46.7–58 μm in length. (3) Choanosomal oxy- and strongylasters with 10–14 rays, diameter 12.7–17–24.2 μm , often with a centrum occupying 15–33% of the diameter. (4) Cortical strongylasters (13.8–16.5–21.2 μm , 8–14 rays) intergrade with latter but usually lack centrum, frequently roughened and spined, especially distally. Some large ones have tylote to lanceolate (mucronate) rays. (5) Acanthomicrorhabds, transitional to sanidasters, 5.6–7.6–8.5 \times 0.9–2.4–3.2 μm .

Remarks. The body of holotype must be regarded as lost. All that remains in the British Museum (Natural History) is a flimsy sketch by Carter and a slide made by Sollas, presumably from the holotype (BMNH 1/28). Sollas (1888) seems to have based his redescription chiefly on "tracings illustrating the structure of this sponge obtained from Mr. Carter." Except for the conflicting measurements of thickness of the cortex and its parts, given by Sollas, and the absence in the new specimen of the "low mulberry-like elevations", there is good agreement. Carter's specimen was much smaller than the new one and it seems likely that the elevations in question, if always present in young specimens, disappear with growth. The BMNH

specimen, from Maria Island, Tasmania, agrees well with the present specimen in macroscopic traits, and also lacks the regular round elevations.

Ancorina geodides seems to be closest to *A. murrayi* (Sollas), a species known only from Bass Strait, particularly in spiculation. As Sollas (1888) already remarked, his species differs chiefly in its conulose surface, and in its megascleres being much larger.

***Ancorina repens* sp. nov.**

Plate 1 figure 3, plate 18 figures 4–6,

plate 19 figures 1, 2, text-figure 5

Holotype: NMV F51930, Station KG 6 (Tasmania, Winter Cove, E side of Deal Island, Kent Group; granite boulders with algae, depth 3–6 m).

Diagnosis. Slug-shaped with short pedicels, very firm. Surface rough, finely rugose, greyish brown, mottled. Oscules inconspicuous, scattered. Cortex thick, stratified, with abundant megascleres in crowded to overlapping umbels. Choanosome dense, light brown, with megascleres in confusion, with crowded euasters.

Description. Slightly compressed stolon of uneven thickness, four points of attachment at base. 11 cm long, 2–2.5 cm high, 1.5 cm wide, bluntly pointed. Colour in life dark greyish brown, mottled. Very firm, little compressible. Surface slightly rough, potato-like. Faint, finely dendritic-vermiculate pattern on top. Oscules inconspicuous, numerous, 100–300 μm wide, regularly scattered on top. On upper portion, vermiculate-anastomosing, tangential canals below surface, 0.5–1 mm wide, roofed by smooth outer portion of cortex. These canals are not completely open, but contain narrow widely spaced penicils of megascleres, supporting the dermis. Surface elsewhere regularly microtuberculate to rugo-reticulate, reflecting cortical penicils of megascleres. In few areas, tangential megascleres or their bundles form subparallel lines. Ostia regularly placed in depressed interstices of fine surface pattern.

Choanosome light brown, dense; irregularly meandering and anastomosing canals below 100 μm wide. Megascleres mostly in confusion, occasionally arranged in loose sheafs. Triaenes with cladomes just below the cortex less numerous than at surface. Cortex 2.5–3 mm thick, exceptionally rich in megascleres arranged in narrow, mostly overlapping, complex umbels, which begin c. 2 mm below cortex and often branch once or twice. Branches of umbels, some with 2–3 megascleres, intersect at angles 20–30°, some up to 60°.

Cortex consists of: (1) Outer layer, 550–600 μm thick, non-fibrous, in turn comprising: (a) Thin

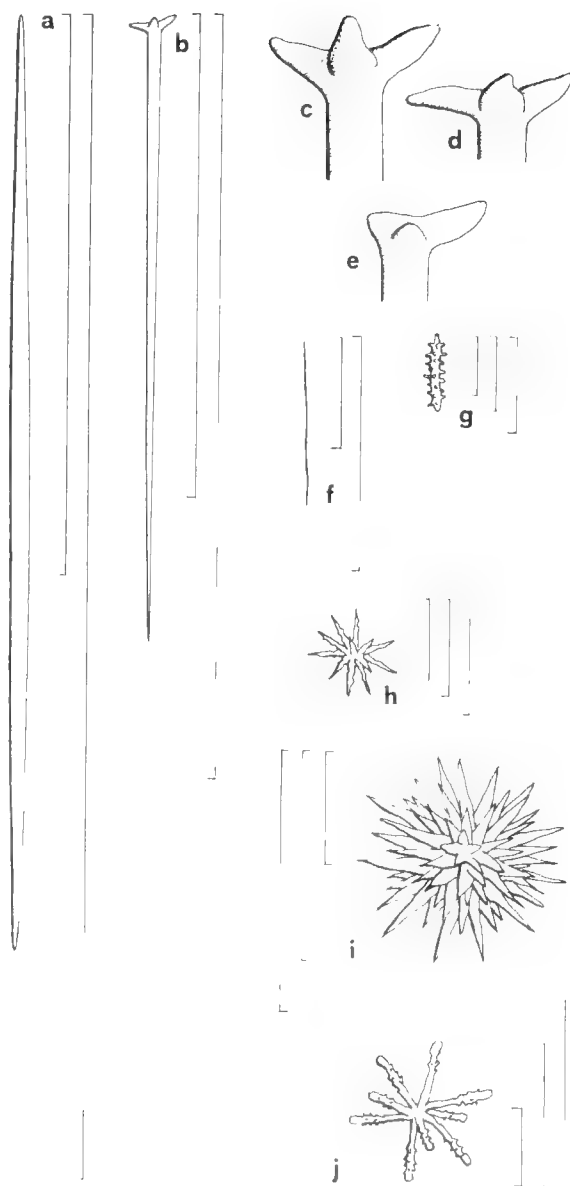


Figure 5. *Ancorina repens* sp. nov., spicules. a. Oxea (with example of mean length), $\times 65$. b. Triaenes, $\times 65$. c–e. Enlarged cladomes, $\times 249$. f. Peripheral strongyles, $\times 65$. g. Acanthomicrohabds, $\times 748$. h. Small oxyasters of outer cortex, $\times 748$. i. Large oxyspherasters of cortex, $\times 748$. j. Choanosomal tylasters, $\times 748$.

outer zone with crowded acanthomicrohabds, numerous cladomes of triaenes and ends of oxea flush or slightly protruding; (b) inner zone with small oxyasters and scattered acanthomicrohabds. (2) Inner layer, very collagenous, coarsely fibrous (convolute fibres), 2 mm thick, off-white, with scattered large multirayed oxyspherasters and acanthomicrohabds. Below cortex and between bases of the umbels are regular subcortical crypts, com-

municating with ostia through few crooked chones, visible in section only where spicular umbels do not overlap. Chones 250–350 μm wide, with thick sphincter below outer cortex. Chones lined by numerous multirayed oxyasphasteres and scattered small oxyasters and acanthomicrohabds.

Choanosome with conspicuous and crowded strongly-and tylasters. Frequent sand grains strewn in choanosome and cortex.

Spiculation: (1) oxea, mostly straight, fusiform (occasionally curved in choanosome), 927–1622–2037 \times 11.3–28.9–44.2 μm ; (2) mostly plagiotriaenes, many mixed as orthoplagiotriaenes (clads at variable angles), asymmetrical also in partial reduction of clads or suppression (diaenes, monaenes, styles), particularly in choanosome, where rhabds are often curved: rhabds 841–1068–1333 \times 15.6–20.5–28.6 μm , clads 17.3–40–62.4 μm ; (3) thin strongyles of peripheral choanosome (rare) 194–409 \times 2.1–3.5 μm ; (4) acanthomicrohabds, 8.6–11.2–14.1 \times 2–2.9–4 μm ; (5) small oxyasters of outer cortex, without or with a small centrum, 9–20 rays diameter 12.2–14.3–17.4 μm ; (6) large, densely rayed oxyasphasteres of cortex, chiefly lining the chones; diameter 16.8–31.5–39.4 μm , centrum 38–57% of diameter; (7) strongylasters and tylasters (few oxyasters) of choanosome, with rays often distally roughened to spined, or roughened to crooked throughout, number of rays 6–12, diameter 11.8–21.9–31.2 μm .

Remarks. The present species is most closely related to *Ancorina acervus* (Bowerbank). *A. repens* is distinguished by a thicker cortex, stunted triaenes (clad lengths generally equal to double rhabd diameter) with shorter and thinner rhabds, absence of cortical microxea, presence of subcortical thin strongyles and presence of densely rayed oxyasphasteres. The large, distally roughened and spined oxyasters and tylasters of the choanosome may be homologous to the “anthasters” sensu Bergquist (1965: 192f., description of *Ancorina acervus*).

Ancorina robusta (Carter)

Plate 1 figure 4, plate 19 figure 3,

text-figure 6

Stelletta bacillifera var. *robusta* Carter, 1883b: 351, pl. 14 fig. 3 (Port Elliot and Adelaide, SA). — Carter, 1886b: 123 (Port Phillip Heads, Vic., 34 m).

Ecionema bacilliferum var. *robustum*. — Sollas, 1888: 197 (résumé).

Ancorina (*Ecionemia*) *robusta*. — Lendenfeld, 1903: 63 (résumé).

Psammastra bacillifera var. *robusta*. — Dendy, 1905: 81 (discussion).

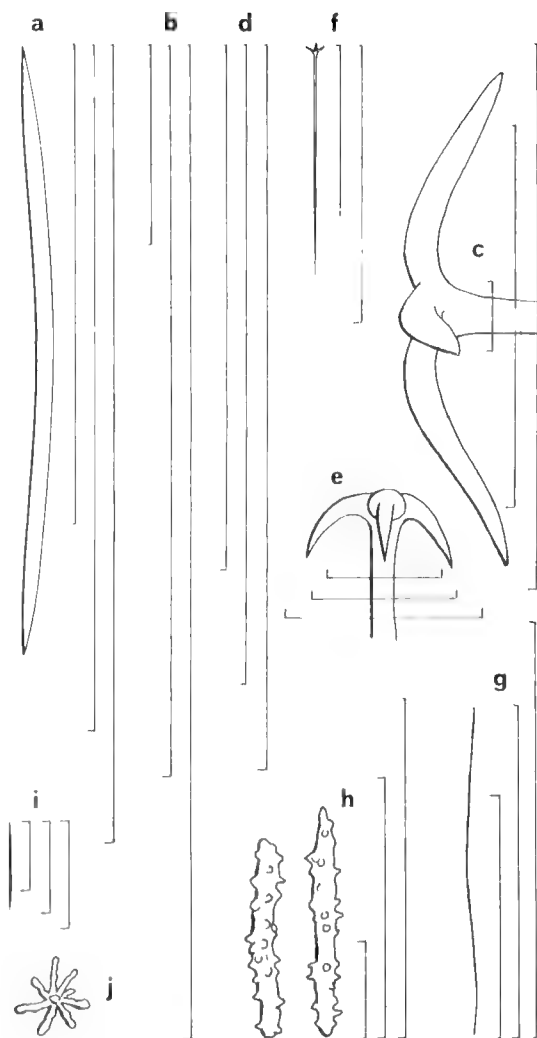


Figure 6. *Ancorina robusta*, spicules. a. Oxea, $\times 68$. b. Range of orthotriaenes, $\times 68$. c. Cladome of orthotriaene, $\times 263$. d. Range of anatriaenes, $\times 68$. e. Cladome of anatriaene, $\times 263$. f. Small triaenes of deeper choanosome, $\times 68$. g. Flexuous strongyles, $\times 68$. h. Acanthomicrohabds, $\times 790$. i. Cortical oxea, $\times 68$. j. Tylasters, $\times 790$.

Psammastra gigas Lendenfeld, 1888: 39 (Port Jackson, NSW). — Whitelegge, 1889: 180 (off Green Point, Port Jackson).

Material examined. Station KG 5, one specimen (F51931); station KG 6, one specimen (F51932); station BSS 187, one specimen (F51933). Type specimens and hypotypes of *Stelletta bacillifera* var. *robusta* (BMNH). Holotype (schizotypes) of *Psammastra gigas* (AM).

Diagnosis. Irregularly massive to bulbous, large, tending to expand from waisted base. Tough, slightly compressible. Surface red-brown to dark brown, smooth to faintly rugose. Oscules conspicuous, often clustered. Cortex ill defined, of medium

thickness for genus, with megascleres in regular umbels. Choanosome dense, cream to greenish yellow. Large orthotriaenes with regularly curved clads numerous, cladomes staggered around boundary choanosome/cortex and flush at surface. Acanthomicrohabds at surface exceptionally large for genus.

Description. Specimen F 51931 (pl. 1 fig. 4) bulbous, slightly compressed, expanding from narrow base, $7.5 \times 7.5 \times 5.5$ cm. Apical, tilted depression contains 8 oscules 2–4 mm wide. Coralline and other algae encrusting on side.

Specimen F 51932 swollen, expanding from base of coalescent short pedicels. Main mass asymmetrically bulbous, slightly compressed, top sloping lengthwise. On highest side two groups of oscules (4 and 2), 2 to 9 mm wide. Greatest height 9.5 cm, width 9.5×11.5 cm.

Specimen F51933 compressed-bulbous with narrow base, but more symmetrical, with crescent-shaped, flattened top bearing scattered oscules 0.5–1.5 mm in diameter. Upper sides bear vague radial folds. Base 4×5 cm, height 10 cm, width 9.5×7 cm.

Colour in life red-brown to dark purplish brown; dull cream to greenish yellow around base and neck as for choanosome. (10 R6–7/4–8 and 10 R5/6 for top of F51932.) In alcohol beige. Tough, slightly compressible.

Surface smooth except for vague rugose pattern with faint meandering depressions and pits. Rugae and depressions 2–3 mm wide. Ostia scattered regularly except for some patches of irregular outline, without relation to rugose surface-pattern.

Choanosome dense, except periphery with regular pararadial arrangement of incurrent canals (with intervening anastomoses) and of megascleres. Deeper in choanosome conspicuous excurrent canals with irregularly oblate cross-sections and transverse fine ridges and folds in walls. Cortex ill defined, delimited below by staggered cladomes of loosely strewn, pararadially arranged trianenes of peripheral choanosome. From this zone, regular brushes of trianenes fan out to surface with little overlap, cladomes flush. Width and individuality of brushes variable. Cortex 1.5 mm thick, with outer, pigmented portion (1 mm thick) and meandering ectochones. Superficial zone of crowded cladomes and acanthomicrohabds. Lower part of cortex fibrous, lighter. Intracortical crypts or anastomosing canals between bases of spicular brushes, surrounded by outer pigmented layer. Intracortical crypts and incurrent canals lined by scattered tylasters and acanthomicrohabds.

Scattered small, thin oxea in cortex and outermost choanosome. Flexuous strongyles of inter-

mediate length in inner cortex and peripheral choanosome, with ends slightly roughened. Tylasters rare in choanosome.

Spiculation: (1) Oxea, 903–1210–1412 \times 6.2–14.9–21.2 μm ; (2) orthotriaenes with gently curved clads: rhabds, 354–1295–1763 \times 4.7–17.8–26.9 μm , length of clads 15.8–86.6–123 μm ; (3) anatriaenes (rare, often broken, more frequent in F51933): rhabds, 922–1127–1279 \times 8.7–15.6–19.4 μm , clads (chord perpendicular to rhabd) 26–33–44.7 μm ; (4) few small ortho- and plagiotriaenes of the deeper choanosome, probably developmental: rhabds, 300–489 \times 2.9–8 μm , clads 7–16.5 μm ; (5) flexuous strongyles, 432–588–737 \times 1.5–2.8–3.5 μm ; (6) acanthomicrohabds (width with spines), 14.7–39.9–52 \times 3.2–7.8–9.8 μm ; (7) small cortical oxea, 124.7–163.2–188.5 \times 1–2–2.8 μm ; (8) tylasters without centrum, knotty rays, diameter 8.7–11.6–14.6 μm .

Remarks. *Ancorina robusta* differs from most congeneric Indo-Pacific and Australian species (*A. acervus* (Bowerbank), *A. murrayi* (Sollas), *A. australiensis* (Carter), *A. geodides* (Carter), *A. alata* Dendy, *A. progressa* Lendenfeld, *A. stalagmoides* Dendy), and from the two new species by having much larger microhabds. Only in *A. corticata* (Carter), from South Australia, do microhabds reach similar dimensions ($40 \times 4.2 \mu\text{m}$) according to the description (reported in Sollas, 1888: 200; Lendenfeld, 1903: 63). It differs from *A. robusta* in its thinner cortex (500 μm), smaller orthotriaenes, lack of anatriaenes, of thin strongyles of intermediate size, and of small cortical oxea.

Ancorina suina sp. nov.

Plate 1 figure 5, plate 19 figures 4–6,
text-figure 7

Holotype: NMV F51934, Station KG 6 (Tasmania, Winter Cove, E side of Deal Island, Kent Group; granite boulders with algae, depth 3–6 m).

Diagnosis. Irregularly lobose, angular, with folds and furrows, hard. Surface dull orange-brown to cream. Cortex tough, 1–3 mm thick, smooth to faintly rugose, internally off-white, with irregularly scattered to bundled megascleres. Choanosome dense, light tan, with megascleres more abundant than in cortex, in confusion.

Description. Dimensions $5.5 \times 5 \times 4$ cm. Irregularly lobose, angular, with folds and furrows in different directions. Several small areas of attachment on opposite sides. Colour in life dull orange brown, grading to pale fawn and cream. In alcohol, surface beige, cortex off-white in section, choanosome light tan.

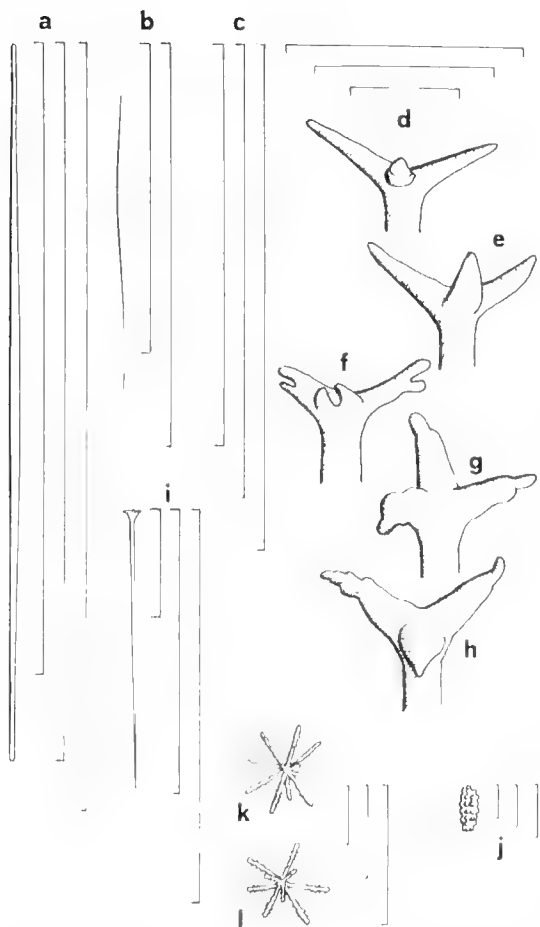


Figure 7. *Ancorina suina* sp. nov., spicules. a. Oxea, $\times 68$. b. Thin choanosomal oxea, $\times 68$. c. Range of triaenes, $\times 68$. d-h. Enlarged cladomes, $\times 263$. i. Small choanosomal triaenes, $\times 68$. j. Microrhabds, $\times 790$. k-l. Tylasters and strongylasters, $\times 790$.

Consistency hard. Surface smooth in some areas, in others with finely dendritic depressions and rugae, accentuated by colour. Oscules minute, regularly scattered in furrow on one side.

Cortex very collagenous, of variable thickness: 1 to 3 mm. Megascleres relatively scanty in thicker portions, either scattered at various angles, often crossed, some almost tangential, or arranged in bundles gradually expanding towards surface. Many bundles in angular course in lower cortex, with many spicules repeatedly broken, often reaching surface obliquely. Many megascleres flexuous. Outermost triaenes have cladomes flush with surface or slightly protruding, as for points of oxea. Megascleres in choanosome much more numerous, chiefly in confusion, some in bundles, including distinctive but infrequent small oxea and small intermediate triaenes. Outermost zone of the cortex, 10–30 μm thick, occasionally to 250 μm , contains

crowded to packed acanthomicrohabds. Collagen of cortex finely fibrous, with meandering and vaguely reticulate strands of fibres arranged in rounded packs; more stratified below. Few chones in deeper cortex, mostly oblique to meandering, narrow, with numerous strongylasters and acanthomicrohabds in linings. Fine chones riddle portions of the outer cortex, 50 μm thick, where microhabds are scanty at the surface and asters more abundant. Microscleres rare elsewhere in cortex below ectochrome. Below cortex zone of discontinuous but extensive crypts, lined by crowded asters. Tylasters abundant interstitially in choanosome. Some sand grains in cortex. In cortex and choanosome scattered balls with radial fibrous structure and clustered opaque granular matter in variable proportions, supposedly symbionts, with diameters 33–80 μm ; often crowded at surface, with outermost protruding portions frequently blackened or truncate.

Spiculation: (1) Oxea, with tips often cylindrical or swollen, 1105–1257–1346 \times 12.6–15.3–18.8 μm ; (2) thin oxea of the choanosome, 541–703 \times 2.8–3.8 μm ; (3) ortho and plagiotriaenes (often malformed, like clads at irregular angles, orthomesotriaenes, stunted dichotriaene, style): rhabd 699–795–885 \times 11.5–15.8–21.8 μm , clads 25–40.4–53.8 μm long; (4) small and intermediate triaenes of choanosome: rhabd 190–499–693 \times 2.9–7.0–11.2 μm , clads 5.3–13.7–23.5 μm long; (5) tuberculate microrhabds, 5.3–6.7–8.3 \times 1.9–2.9–3.9 μm ; (6) tylasters and strongylasters with 6–14 slightly rough to distally spined rays, diameter 8.9–14.0–21.2 μm .

Remarks. *Ancorina geodides* has similar spiculation, with acanthomicrohabds corresponding in size, but triaenes and oxea are almost double in size in *A. geodides*, and cortical and skeletal structure are distinctive. *Ancorina corticata* (Carter) agrees in spicule measurements with *A. suina*, except for acanthomicrohabds, which are larger (40 μm long) and densely spiny in the former. *A. corticata*, furthermore, is round, with relatively large oscules, and peculiar meandrine (brain-like) rugae, with ostia in the interstitial sulci.

Stelletta Schmidt

Stelletta Schmidt, 1862: 46. — Lendenfeld, 1903: 33 in part, (*Myriastrea*, *Pilochrota* and *Anthastra* synonymised). — Dendy, 1905: 77 (definition). — Bergquist, 1965: 195. — Bergquist, 1968: 33, 44 (discussion).

Myriastrea Sollas, 1886: 187. — Sollas, 1888: cxxxviii, 112. — Dendy, 1905: 71 (definition). — Dendy 1916a: 235 (discussion). — Bergquist, 1965: 195. — Bergquist 1968: 44 (discussion, synonymised with *Stelletta*). — Wiedenmayer, 1977a: 177 (synonymy, references).

Pilochrota Sollas, 1886: 189. — Sollas, 1888: cxxxviif., 120. — Dendy, 1905: 74 (denfinition). — Dendy, 1916a: 235 (synonymised with *Myriastra*).

Anthastra Sollas, 1886: 191. — Sollas, 1888: cxxxviii, 138.

Diagnosis. Ancorinidae with one to three types of euasters, without microrhabds or sanidasters.

Remarks. Lévi (1973: 595) retained *Myriastra* as a distinct genus, with only one category of asters, versus 2–3 categories in *Stelletta*. Bergquist's arguments for merging the two genera are here accepted. They are corroborated by the following species, with one sort of aster, being closely related to two species with two sorts of asters.

***Stelletta arenitecta* sp. nov.**

Plate 1 figure 6, text-figure 8

Holotype: NMV F51941, Station KG 5 (Tasmania, Garden Cove, N side of Deal Island, Kent Group; boulders with algae).

Paratype: NMV F51942, Station KG 6 (Tasmania, Winter Cove, E side of Deal Island, Kent Group; granite boulders with algae, depth 3–6 m).

Diagnosis. Sprawling, irregularly tuberculate to lobulate; firm, but easily torn. Surface red-brown in life. Cortex 1–2 mm thick, full of sand, with rare spicules. Choanosome light beige, with megascleres in confusion, triaenes rare and atrophied. Euasters scarce.

Description. Sprawling, capriciously shaped masses with lacunose outline at base; twisted ridges, lobes

and tubercles on top and sides, separated by furrows and lacunae. Lobes and furrows 0.5–1 cm wide, lacunae up to 2.5 cm. Dimensions 8 × 10 cm width, 4 cm height in holotype, 6 × 7 cm by 3 cm in paratype. Thin plates of coralline algae on paratype.

Surface conspicuously sandy, red-brown (2.5 R5/8) in life, now greyish beige, choanosome light beige. Firm, little compressible, tearing easily. Except for few minute oscules in depressions, no orifices.

Cortex 1–2 mm thick, packed with sand. Small enclaves of sand in choanosome. Cortex with clear, finely fibrous structure without orientation, except for some fibres enveloping sand grains. Some oxea occur in sandy cortex, either scattered or in oblique bundles or brushes.

Choanosome contains oxea in confusion, of variable abundance: scattered, occasionally in irregular bundles in paratype, frequently felted in holotype. Triaenes with atrophied cladomes scarce (below 2% of megascleres) and scattered. Small asters scarce, numerous in peripheral choanosome, also in cortex. Subcortical crypts irregularly distributed, narrow, slit-like, some well below cortex. They communicate with oblique, twisted and branching crevice-like incurrent canals. Excurrent canals round, up to 1.5 mm wide. Choanosome almost packed with minute symbionts, in the shape of mulberries, with diameter as for asters. Some occur in cortex. Spiculation: (1) Oxea and strongyloxea transitional to strongyles and styles, mostly straight, hastate to fusiform, 286–645–873.5 × 2.6–9.8–14.4 µm. Thinnest oxea in paratype (absent in holotype) frequently flexuous, broken, with corroded ends, possibly separate category (300–453 × 2.6–2.9 µm). (2) Plagio- to orthotriaenes with much reduced, regular or irregular cladomes, rhabd 503–628–704 × 5.3–9–10.3 µm, clads 3.8–9.5–17.1 µm long. (3) Strongylasters to tylasters (intergrading), frail, without centrum, 6–9 very slender, smooth to slightly knotty, straight rays, 6.5–11.3–13.8 µm in diameter.

Remarks. *Stelletta arenitecta* falls within a small group of species containing much foreign detritus and relatively rare, reduced triaenes of irregular distribution. *Stelletta arenaria* Bergquist (1968: 45) is comparable to *S. arenitecta* in its cortex, and in the rarity of its triaenes. It differs in shape, colour, arrangement and size of megascleres, less reduced triaenes, and abundance of asters which fall into two categories (tylasters and "chiasters", i.e. anthasters sensu Wiedenmayer, 1977a, nec Bergquist, 1965). *Stelletta vestigium* Dendy (1905: 78) resembles *S. arenitecta* in the shape, size and

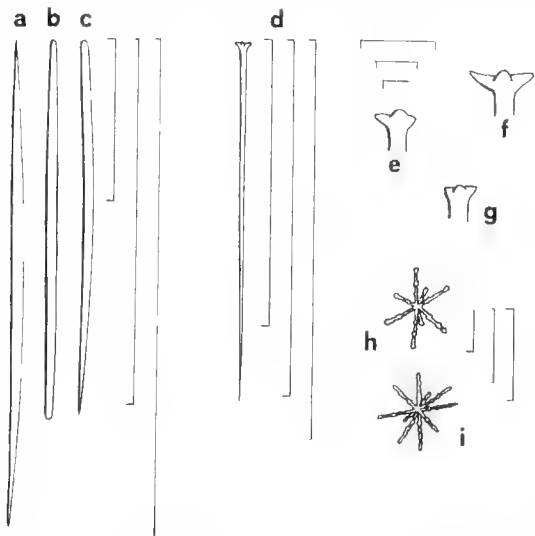


Figure 8. *Stelletta arenitecta* sp. nov., spicules. a–c. Oxea, strongyles, and styles, ×68. d. Triaenes, ×68. e–g. Enlarged cladomes, ×263. h–i. Tylasters and strongylasters, ×790.

arrangement of its megascleres, but differs in external shape, colour, lack of cortex, abundance of foreign matter in the choanosome, and in possessing two categories of asters (oxyspherasters and oxyasters). There seems to be a fourth, undescribed sandy species of *Stelletta*, represented by a specimen from Port Phillip Bay (BMNH, Dendy Coll. RN 614, double-registered 1925.11.1.611 and—438, with 3 slides in cabinet 1, trays 43, 44, which I have not examined), labelled with a manuscript name by Burton. It is massive, with almost smooth surface, no macroscopically visible cortex, and sand distributed throughout the sponge.

Rhabdastrella Thiele

[*Aurora*] Sollas, 1888: cxxxix, 187 (nec *Aurora* Ragonot, 1887). — Dendy, 1916a: 242 (definition, discussion, review). — Lévi, 1967a: 240 (discussion, brief review). — Bergquist, 1968: 54 synonymised with *Rhabdastrella*.

Rhabdastrella Thiele, 1903a: 934. — Bergquist, 1968: 33, 54 (discussion).

Diastra Row, 1911: 300. — Dendy, 1916a: 245 (discussion, synonymised with *Aurora*). — Bergquist, 1968: 54 (discussion, synonymised with *Rhabdastrella*).

Aurorella de Laubenfels, 1957: 245 (replacement name for *Aurora* Sollas, nec Ragonot). — Hechtel, 1983: 80 (as subgenus of *Rhabdastrella*).

Diagnosis. Ancorinidae with reduced triaenes or without triaenes; euasters comprise massive types (spherasters, anthospherasters, sterrospherasters), commonly in cortical layer.

Rhabdastrella cordata sp. nov.

Plate 1 figure 7, plate 20 figure 1,

text-figure 9

Holotype: NMV F51935 Station KG 6 (Tasmania, Winter Cove, E side of Deal Island, Kent Group; granite boulders with algae, depth 3–6 m).

Diagnosis. Massive-lobate, low, firmly rubbery; base slightly constricted, folded. Surface mottled, dark grey-brown, purple, pale brown, and dull yellow. Surface smooth to faintly rugose. Oscules small, numerous, tending to cluster. Cortex 500–750 μm thick, light, collagenous, lower boundary indistinct, with megascleres in vague umbels, and spherasters of 2 sizes in thin crust at surface. Choanosome dense, with megascleres scattered or loosely bundled. Triaenes often irregular.

Description. Like a heart lying on its side. Height 3.5 cm, width 5 \times 5.5 cm. Base of attachment slightly contracted. Colour in life mottled: dark grey-brown, mixed with purple, pale brown, dull yellow. Sides finely speckled purple. Base, like choanosome, light beige to cream, with sharp boundary to darker top and sides: 5 RP3/2, 10 R8/4, 7.5

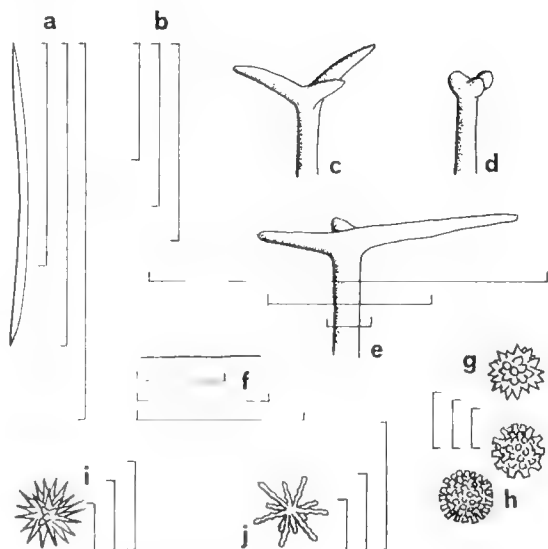


Figure 9. *Rhabdastrella cordata* sp. nov., spicules. a. Oxea, $\times 68$. b. Range of triaenes, $\times 68$. c–e. Enlarged cladomes, $\times 263$. f. Choanosomal strongyles, $\times 68$. g. Spherasters of inner cortex and choanosome, $\times 263$. h. Anthospherasters of outer cortex, $\times 263$. i. Superficial oxyspherasters, $\times 790$. j. Choanosomal strongylasters, $\times 790$.

YR9/4, 5 R5/10, 2.5 R5/4, 5 R6/2, and neutral black-grey. Firmly rubbery. Surface is partly smooth, partly faintly rugo-vermiculate. Narrow zone on one side near point now finely wrinkled. Broad side with deep oblong invagination. Numerous oscules, 0.2–1 mm wide in life, on top, in 5 to 6 separate or confluent fields. Folds and invaginations surround base.

Cortex mostly 500–750 μm thick, finely fibrous and weakly pigmented almost throughout. Very thin hyaline ectochrote. Choanosome dense and collagenous; boundary with cortex indistinct. Subcortical crypts or canals infrequent and irregular. Megascleres in choanosome in widely spaced bundles and loosely scattered interstitially. Orientation of the latter mostly random in deeper parts, more parallel with bundles in periphery. Bundles below cortex usually oblique, some almost tangential, branching irregularly, expanding into brushes well below cortex. Contiguous brushes separated or overlapping irregularly. Their apices uneven, with cladomes of triaenes commonly placed in inner third-half of cortex, oxea frequently reaching higher. Large spherasters (mostly oxyspherasters with blunt rays) scattered in choanosome and cortex. Small asters of various shapes rare in choanosome. In outer quarter-two-fifths of cortex, spherasters are crowded to packed in clusters, mostly modified as anthospherasters. Conspicuous

zone free of spicules (except for occasional oxea and scattered spherasters) between ends of megasclere-brushes and the crowded spherasters of outer cortex. In hyaline ectochrote and between outermost anthospherasters infrequent small spherasters of a distinct category. Spiculation: (1) Oxea, straight to curved or bent, fusiform to hastate, mostly with blunt, conical, or mucronate tips, $387\text{--}526\text{--}657 \times 3.2\text{--}9.3\text{--}15 \mu\text{m}$; (2) triaenes, often irregular, with variable directions of single clads (mixed ortho-, plagio- and pro-types), one, two, or all clads stunted or suppressed (diaenes, monaenes, tylostyles), occasionally as mesotriaenes, but with orthotriaenes dominating in periphery and cortex; rhabd $207\text{--}284\text{--}342 \times 5.4\text{--}9\text{--}13.2 \mu\text{m}$, length of clads, $9.7\text{--}37.4\text{--}90.3 \mu\text{m}$; (3) thin strongyles of choanosome, $150\text{--}230\text{--}294 \times 2 \mu\text{m}$; (4) large spherasters, with blunt, conical to terete rays (mostly in choanosome and inner portion of cortex) and anthospherasters with truncate rays (near surface), diameter $18.6\text{--}22.1\text{--}25.5 \mu\text{m}$, centrum $54\text{--}64\text{--}73\%$; (5) small oxy- and strongylospherasters at the surface, diameter $7.0\text{--}10.3\text{--}13.4 \mu\text{m}$, centrum $34\text{--}46\text{--}66\%$; (6) small asters of choanosome, of variable types (oxy-, strongyl- and tylasters), mostly without or with small centrum (rarely around 35%), and 6–18 rays, diameter $7.8\text{--}11.9\text{--}19.4 \mu\text{m}$.

Remarks. See next species.

***Rhabdastrella intermedia* sp. nov.**

Plate 1 figure 8, plate 20 figure 2,
text-figure 10

Holotype: NMV F51936, station KG 6 (Tasmania, Winter Cove, E side of Deal Island, Kent Group; granite boulders with algae, depth 3–6 m).

Diagnosis. Irregularly cake-shaped, with truncate, hollow top, firmly rubbery. Surface purplish black, tuberculate to rugose, partly folded on sides, smoother in apical depression, which contains minute, clustered oscules. Cortex stratified, more pigmented in outer portion, $460\text{--}650 \mu\text{m}$ thick, with megascleres in erect, often overlapping umbels, and thin superficial crust of packed spherasters. Choanosome light cream, with megascleres mostly in confusion, and abundant scattered small euasters. Triaenes rare, atrophied.

Description. Irregularly cake-shaped, somewhat compressed, with tuberculate and coarsely rugose, steep sides. Top with concave depression of pear-shaped outline, sloping lengthwise, surrounded by bulging rim 1 cm thick. Width at sides $5 \times 5.5 \text{ cm}$, height at high end 3.5 cm, at low end 1.5 cm. Colour in life, mostly preserved in alcohol, soot-

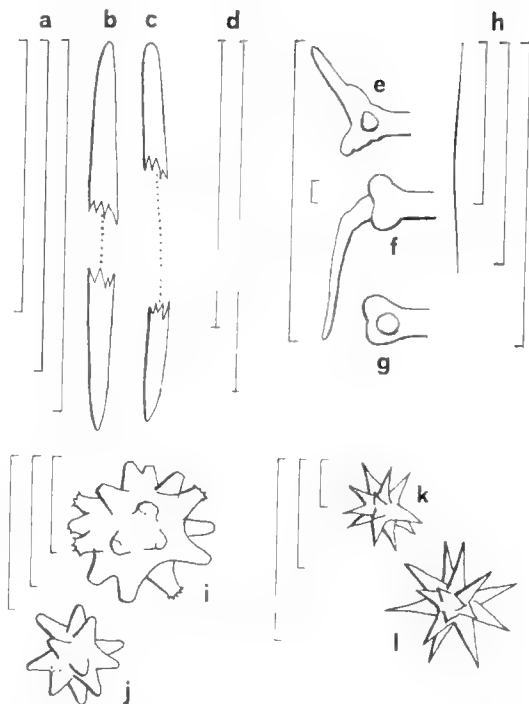


Figure 10. *Rhabdastrella intermedia* sp. nov., spicules. a. Range of oxea, $\times 68$. b–c. Enlarged ends of oxea, $\times 263$. d. Range of triaenes, $\times 68$. e–g. Enlarged cladomes with range of widths, $\times 263$. h. Choanosomal thin oxea, $\times 68$. i–j. Cortical spherasters, $\times 790$. k–l. Choanosomal oxyasters, $\times 790$.

black, tinged purple to red (5–10 RP3/1 to 2.5 R5/2 in life, N3/R2 in alcohol); bulging rim slightly lighter. Firmly rubbery in life. Choanosome light cream (2.5 Y9/2). Depression, with fine folds along axis and round invagination near the lower end, riddled by minutes oscules, $100\text{--}200 \mu\text{m}$ wide. Rim bears some fine radial folds. Further invaginations on sides and in slightly recessed base. Thin rim of discoloured cortex around base. Surface on elevations of sides smooth, except for fine rugo-reticulate pattern with faint relief, accentuated by colour. Ostia crowded in this region, restricted to the depressions or scattered, occasionally widely spaced on low tubercles. Skeleton of the deeper choanosome mostly confused. Larger oxea often in bundles, of which principal ones, spaced $500 \mu\text{m}$, erratic, often angular, mostly oblique to the surface. Bundles may branch and anastomose, some in subsodictyal fashion. Interstitial megascleres thinner, including small strongyles, usually scattered loosely in deeper parts, frequently aligned with principal bundles in peripheral choanosome. Scattered small asters very abundant throughout

choanosome. Matrix generally dense, lightly collagenous, almost packed with clustering unicellular symbionts (diameters around 12 μm). In peripheral choanosome, with filamentous algae, just below zone of subcortical crypts, principal spicule-bundles expand into wide, complex umbels, commonly erect and much overlapping. Other umbels narrow, not overlapping, oblique. All umbels end at surface.

Cortex 460 to 650 μm , in two layers: (1) Outer cortex, heavily pigmented, 110–250 μm , with spherasters packed between ectochones; (2) Inner cortex, less pigmented, fibrillous, with scattered spherasters (rare in the basal part), 350–400 μm . Immediately below is a zone, 250 μm , of regular subcortical crypts, between bases of umbels, with matrix lighter than in subjacent choanosome, containing filamentous algae. Ectochones narrow, meandering to oblique, wider endochones lined by small asters, leading into subcortical crypts. Spiculation: (1) Fusiform and hastate oxea and strongyloxea, frequently slightly bent, 494–603–678 \times 5.6–12.4–15 μm . (2) Trianaes, of different types, rare, stunted in various ways (ortho-, ana-, plagiotrianaes to -monaenes); types with one or two clads much reduced or suppressed most common, some with all clads suppressed (subtylostyles); no regular types; some have subterminal aborted clads in addition; rhabds 520–638 \times 10.6–14.1 μm , clads 5.3–70.2 μm in length. (3) Thin oxea and strongyles of choanosome, some (especially the thinnest) very flexuous, 295–404–549 \times 2–3.3–5.7 μm . (4) Cortical oxy- and anthospherasters, the latter often mixed; with rays conical to blunt, smooth to distally acanthose, and truncate in same spheraster, diameter 15.4–20.9–24.3 μm ; centrum 42–49–57%; (5) choanosomal oxyasters, diameter 7.3–17.0–28.7 μm , centrum 19–29–38%.

Remarks. Despite similarities in spicule types present and their measurements, there are enough differences to regard *Rhabdastrella intermedia* and *R. cordata* as distinct species and not as extreme forms of a polymorphic species. The chief differences are in cortical and skeletal structure, in morphology, relative abundance and distribution of choanosomal and cortical asters, in the absence of regular orthotrianaes in *R. intermedia*, and in trianaes having much shorter rhabds in *R. cordata*.

In his brief review of 14 species then known in the genus, Lévi (1967a: 240) distinguished three groups: (1) with orthotrianaes, (2) with plagiotrianaes, and (3) without trianaes. *Rhabdastrella tenuis* (Lindgren) should be added to group 2. Of the two Brazilian species described more recently, *R. virgula* Boury-Esnault (1973a: 270) falls to group

3, and *R. fibrosa* Hechtel (1983: 81) to group 1 of Lévi. Neither of the new species falls comfortably into one of these groups, though *R. cordata* might be included in the first on account of the dominance of orthotrianaes. Of the species included by Lévi in this first group, *R. primitiva* (Burton, 1926c) shows some similarities in spiculation with *R. cordata* (distinct category of small cortical spherasters; tylasters and microxea of the choanosome), but the megascleres are distinctly larger, with only regular orthotrianaes. *R. globostellata* (Carter), with synonyms *Aurora providentiae* Dendy (1916a) and *Stelletta discolor* Börsraug (1913), has cortical spherasters and choanosomal oxy- to strongylasters (no centrum, slender rays) of much larger dimensions than in either of the new species. *Rhabdastrella reticulata* (Carter, 1883b; see Sollas, 1888: 188), has cortical spherasters and choanosomal stringylasters comparable to those in *R. cordata*, but lacks special small spherasters, thin choanosomal strongyles, and has larger megascleres. *R. rowi* (Dendy, 1916a) has larger megascleres, and distinctive cortical sterrospherasters. *Rhabdastrella spinosa* (Lévi, 1967a) has again larger megascleres, and cortical spherasters up to 45 μm in diameter, with a centrum not exceeding 50%. *Rhabdastrella aurora* (Hentschel, 1909; see Bergquist, 1968: 54) is comparable to *R. intermedia* in the frequent irregularity of cladomes, and to *R. cordata* in the presence of special small spherasters at the surface. But the megascleres are again larger than in both new species, and the large spherasters are comparatively scarce, being largely replaced by foreign detritus in the cortex. The spirit collection in the British Museum (Natural History) contains 3 specimens (Dendy's RN 739, 745, 1200, with 16 slides, BMNH cabinet 1, tray 24) of yet another undescribed species, with a manuscript name by Burton. I have not examined the slides, but one of the specimens differs from both new species by having a thicker cortex (1.3 mm) and a dark brown choanosome.

Geodiidae Gray, 1867

Geodia Lamarck

Geodia Lamarck, 1815 (1814–1815): 333. — Hechtel, 1965: 68, 70 (subdivision in subgenera). — Lévi in Brien et al., 1973: 595 (subdivision).

Subgenera. Nominotypical subgenus, see Wiedenmayer, 1977a: 178 (synonymy, references).

Cydonium Fleming, 1828: 516. — Sollas, 1888: CXLVIII, 218, 254. — Hechtel, 1965: 70.

Isops Sollas, 1880: 396. — Lendenfeld, 1903: 93 (diagnosis, key, review).

Sidonops Sollas, 1889: 277. — Lendenfeld, 1903: 99 (diagnosis, key, review). — Wiedenmayer, 1977a: 179 (type species redescribed).

Diagnosis: (Genus and subgenera) Geodiidae with sterrasters only (no small euasters, spheres, microrhabds) in the cortex. Subgenera distinguished by distribution and relative size of incurrent and excurrent openings. In the nominotypical subgenus, chones have cribriporal roofs and oscules are clustered. In *Cydonium*, incurrent and excurrent orifices are cribriporal and similar in size. *Isops* has solitary ostia and distinct solitary oscules. In *Sidonops*, chones are cribriporal and oscules single, in depressions or deep invaginations.

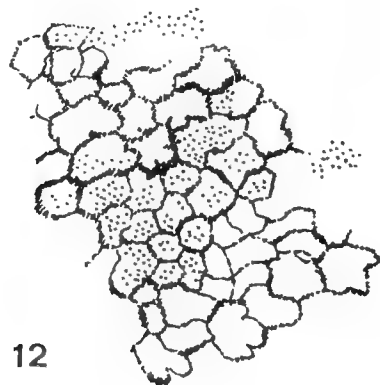
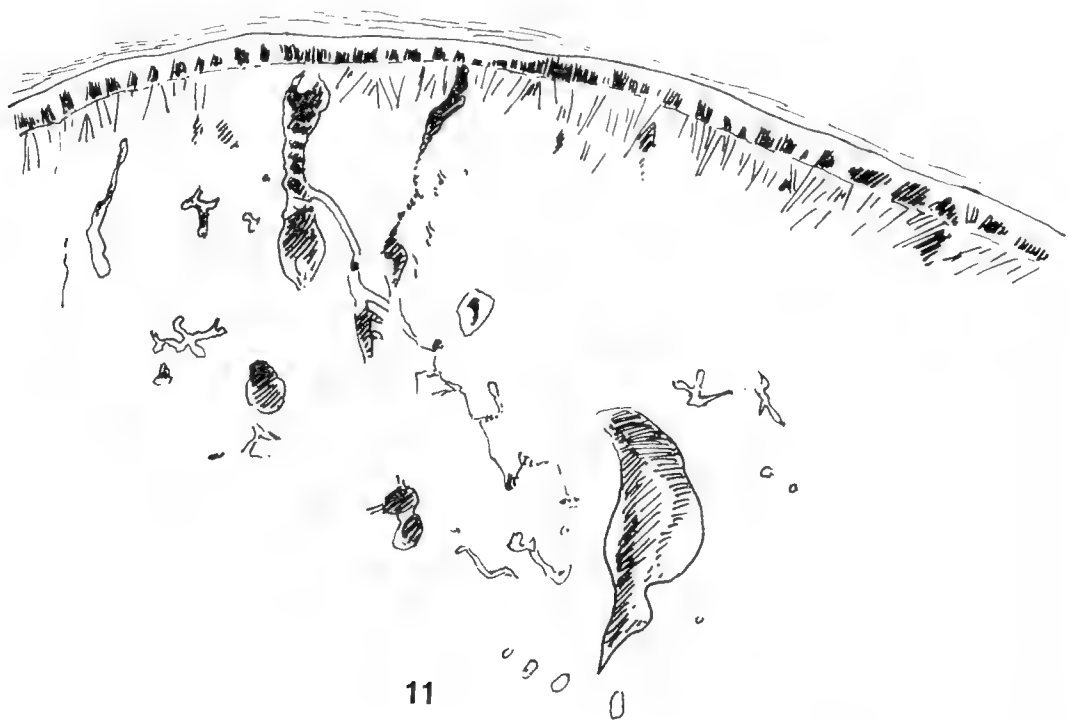
***Geodia (Geodia) punctata* Hentschel**

Plate 2 figure 1, plate 20 figures 3, 4, text-figures 11–13

Geodia punctata Hentschel, 1909: 366, text-fig. 10; pl. 23, fig. 25 (Shark Bay, WA).

Material examined. Station KG 2, one specimen (F51937).

Diagnosis. Stump-shaped, truncate top with confluent depressions containing oscules; firm. Surface smooth, slippery in life, with minutely reticulate pattern, greyish brown mottled with dull purple and yellowish cream. Cortex 300–400 μm thick, often lacunose with conspicuous chones. Sterrasters packed except at base of cortex.



Figures 11, 12. *Geodia (Geodia) punctata*. Details in reflected light. Figure 11. Perpendicular section, $\times 9.8$, showing, from top, oblique view of surface, mottled cortex, peripheral choanosome with brushes of megascleres, and irregular canals of deeper choanosome. Figure 12. Reticulate pattern of surface, $\times 11.7$.

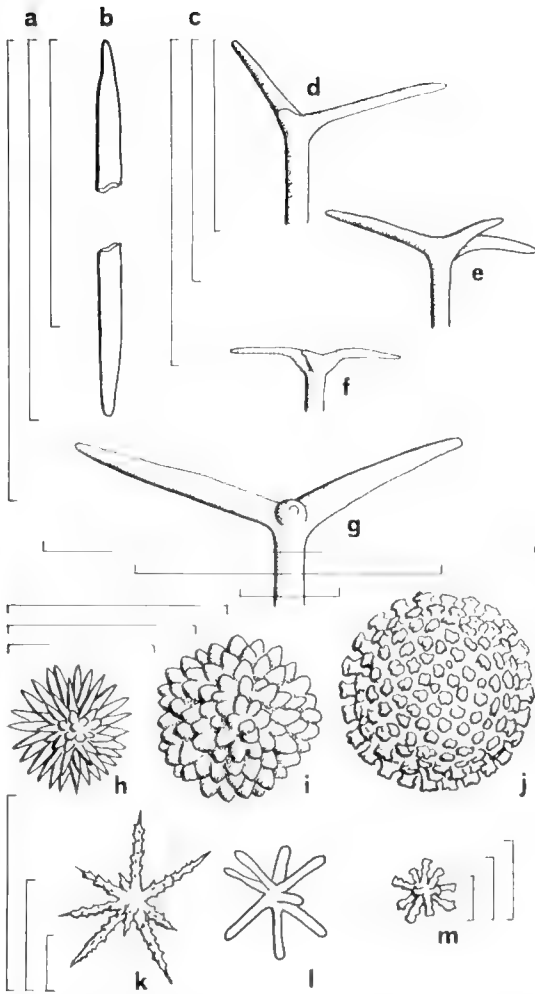


Figure 13. *Geodia (Geodia) punctata*, spicules. a. Range of oxea, $\times 68$. b. Enlarged ends of strongyloxea, $\times 263$. c. Range of triaenes, $\times 68$. d-g. Enlarged cladomes, $\times 263$. h-j. Sterrasters, $\times 790$. h. Earliest developmental stage. i. Intermediate stage. j. Fully grown stage. k-l. Choanosmal asters, $\times 790$. k. Oxyaster. l. Strongylaster. m. Small Strongylospherasters of ectochrote, $\times 790$.

Choanosome yellowish cream, its periphery with megascleres in distinct, often oblique umbels, in deeper parts mostly confused, with numerous small asters. Ortho-to plagiotriaenes often with irregular cladomes.

Description. Like a tree-stump, 7.5 cm high, 6 \times 7 cm wide, with flat, truncate top, slightly constricted base 3.5 \times 4.5 cm wide. Base of attachment oblique, extending in patches to two-thirds of height. Sides partly smooth, partly thrown into shallow furrows and low, broad lobes. Top bears 8-9 partly confluent depressions of rounded-polygonal outline now shrivelled, containing scattered oscules 0.3-0.5 mm wide. Colour in life

greyish brown with purple tinges on top (now greenish grey, 5 Y5-6/2), dull purple (7.5 RP4-6/8) mottled with yellowish cream (5 Y9/4), the latter also in choanosome. Surface in life smooth, slippery. Firm but somewhat compressible.

Surface in purple areas of sides with fine reticulate pattern, like giraffe-skin when magnified, slightly in relief, with fine ostia scattered and clustered (text-fig. 12). Choanosome dense, collagenous; excurrent canals commonly compressed. Megascleres mostly loosely scattered in deeper choanosome; some arranged in bundles with little orientation, or subparallel and oblique to the surface. Small asters of various sizes numerous throughout choanosome, but irregularly distributed, most abundant around canals. Sterrasters scarce in choanosome. Peripheral choanosome 800 μm thick, with brushes of megascleres, some perpendicular and isolated, most oblique, overlapping and crossing each other. Subcortical crypts and canals irregularly and widely spaced, often continuing radially or obliquely below, confluent or connected by fine, irregular anastomoses.

Cortex mostly 300-400 μm thick. Below very thin hyaline ectochrote, with scattered small spherasters, a weakly and finely fibrous main layer. Fibres more distinct and often stratified in inner portion. Sterrasters crowded to packed between chones, except for a thin basal layer of scattered sterasters. Inner boundary of cortex indistinct in collagenous structure, but usually marked by tangential megascleres. Cladomes of scarce triaenes commonly flush with this base, but tips of outermost oxea often reach somewhat higher. Chones 80-100 μm wide in outer half, frequently oblique, widening and confluent below.

Spiculation: (1) Oxea, strongyloxea, strongyles, rarely anisoxea, straight or weakly bent, frequently with telescoped or mucronate ends, 504-667-806 \times 3.8-9.4-14.1 μm ; (2) ortho-to plagiotriaenes, often with irregular cladomes and atrophied clads, rhabds frequently telescoped, strongylote or swollen, rhabds 334-423.7-567.6 \times 7.6-10.1-12.4 μm , clads 22.6-69.7-110.9 μm ; (3) graceful sterasters with relatively long rays, spacing of truncate tips mostly equal to half their width, occasionally equal to their full width, diameter 22.6-29.3-33.8 μm ; (4) choanosomal oxy-to strongylasters with no or small centrum, 6-12 rays, often roughened or finely spined in larger ones, diameter 8.4-17.1-29.7 μm ; (5) small strongylo- and tylospherasters of ectochrote, rare in choanosome, diameter 6.8-9.8-12.5 μm , centrum 38-50%.

Remarks. In the original description, Hentschel mentions infrequent, flexuous, thin oxea, rare

styles (derived from oxea), and very rare anatriacenes, none of which were seen in my preparations. The measurements given for oxea, triacenes, sterrasters and choanosomal oxyasters are all somewhat above mine but whether this is of biogeographic or ecological significance would be premature to decide.

Of the other three species with Australian records here accepted in the nominate subgenus, *G. (G.) carteri* Sollas has generally larger spicules, including dichotriacenes. *G. (G.) globostellifera* Carter has larger sterrasters and much larger megascleres, including protriacenes. *G. (G.) nigra* Lendenfeld is black, has large tylostyles, cortical styles, and plagiotriacenes with longer and thicker rhabds than in *G. punctata*.

Coppatiidae Topsent, 1898

Synonyms. Epipolasidae Sollas, 1888 (nomen nudum; used by Lévi [in Brien et al., 1973]: 598; Vacelet, Vasseur and Lévi, 1976: 23).

Jaspidae de Laubenfels, 1936a.

Remarks. I have already pointed out (Wiedenmayer, 1977a: 172) that the priority of Coppatiidae is not affected by the obsolescence of the type genus. Though Jaspidae was introduced before 1961, and was increasingly accepted following Bergquist (1968: 30) it cannot be said to have won general acceptance in the sense of the ICZN, Article 40b. Lévi et al. have preferred to use Epipolasidae (see synonymy above) and other authors have avoided family names within the order or suborder Epipolasida.

Jaspis Gray

Jaspis Gray, 1867a: 526. — Wilson, 1925: 329 (résumé, in part, not *Rhabdastrella*). — Bergquist, 1968: 33, 55 (discussion). — Wiedenmayer, 1977a: 172 (synonymy, references).

Diagnosis. Coppatiidae with euasters only as microscleres.

Jaspis stellifera (Carter)

Plate 2 figure 2, plate 20 figures 5, 6,
text-figures 14–17

Amorphina stellifera Carter, 1879b: 344, pl. 29, fig. 10 (South Australia).

Stellettinopsis stellifera. — Ridley, 1884a: 477 (discussion).

Coppatias stellifera. — Sollas, 1888: 208 (résumé, discussion).

Jaspis stellifera. — Shaw, 1927a: 422 (excessive synonymy, description from Tasmania, discussion, distribution; possibly *Jaspis coriacea*). — Burton, 1934a: 522 (new record from Great Barrier Reef only). — de Laubenfels,

1954a: 255, text-fig. 155 (Caroline Islands). — Bergquist, 1969: 69, text-fig. 2 (Heron Island).

Stellettinopsis carteri Ridley, 1884a: 476, pl. 43, figs n, n' (Torres Strait).

Coppatias carteri. — Sollas, 1888: 208 (résumé, discussion).

Stellettinopsis tuberculata Carter, 1886b: 126 (Port Phillip Heads).

Coppatias tuberculatus. — Sollas, 1888: 207 (résumé). — Dendy, 1905: 109 (in discussion).

Jaspis tuberculata. — de Laubenfels, 1954a: 224, text-fig. 154, (Marshall Islands).

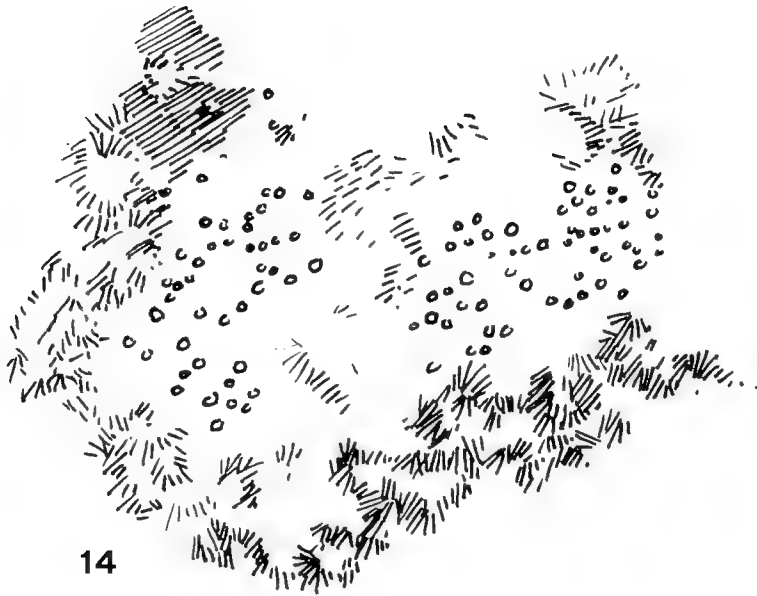
Stellettinopsis lutea Carter, 1886h: 459 (Westernport Bay).

Coppatias luteus. — Sollas, 1888: 207 (résumé).

Material examined. Station KG 1, one specimen (F51938). Type specimens of *Amorphina stellifera*, *Stellettinopsis tuberculata*, and *Stellettinopsis lutea* (BMNH).

Diagnosis. Encrusting to massive, irregularly lobate, commonly enveloping parts of algae, shells, detritus and other foreign objects; leathery, but easily torn; dull purple to brownish drab, or golden yellow throughout, but deeper at surface. Surface smooth to microhispid, vaguely rugose, occasionally tuberculate. Cortex indistinct, about 0.5 mm thick, with matted oxea, paratangential or in confusion. Oscules indistinct. Choanosome with abundant, mostly confused, bent oxea of extreme size range, and numerous minute euasters.

Description. Small, partly enveloping 2–3 empty vermetid shells, together with two smaller sponges (*Gelliodes incrustans* and *Aulorrhiza procumbens*). Vermetid shells partly coated inside, partly penetrated between layers, by the sponge. Colour dull purple to brownish drab on surface (5 RP5/6–8). Leathery on surface, easily torn to crumbly internally. Indistinct cortex of variable thickness, mostly 400–500 μ m, not easily detachable, sometimes discontinuous, or layered. Outer, deeply pigmented layer. Whole cortex commonly packed with oxea in confusion. Oxea at surface either chiefly tangential or in a rugose pattern of matted brushes (text-fig. 14). Lining similar to cortex surrounds larger excurrent canals in choanosome, about 1.5 mm wide. Smaller canals, 50–150 μ m wide, riddle the choanosome. No oscules. Clusters of ostia (cribriporal groups) in slight, saucer-like depressions (text-fig. 14). Single ostia, 50–100 μ m wide, lead to oblique, meandering, often confluent chones of similar diameter, confluent with numerous subcortical crypts (text-fig. 15), commonly arranged in several equidistant layers. Arrangement of megascleres in choanosome mostly confused, scattered or in disoriented bundles. Choanosome with pigmented cells and scattered to packed ellipsoidal bodies, 20–30 μ m long, with cen-



14



15



16

Figures 14–16. *Jaspis stellifera*, details in reflected light, $\times 16.5$. Figure 14. Smooth depression with cribriporal groups surrounded by brushes and felt of megascleres. Figure 15. Perpendicular section through cortex with a cribriporal group, intracortical and subcortical crypts. Figure 16. Perpendicular section showing irregular cortex, small and large canals in choanosome.



Figure 17. *Jaspis stellifera*, spicules. a. Range of oxea, $\times 68$. b. Oxea, enlarged, $\times 263$. c. Style (rare), $\times 263$. d-f. Asters, $\times 790$.

tral clear core surrounded by equal cells. Such bodies were originally described by Carter, and are probably algal symbionts. Scattered foreign debris, throughout choanosome, some quite large. Asters numerous.

Spiculation: (1) Oxea (pl. 20 fig. 6) hastate to fusiform, commonly symmetrically bent, occasionally modified to anisoxea, strongyles and styles, graded size range with little if any relationship between length and thickness, $89\text{--}364.8\text{--}682.8 \times 2.6\text{--}8.7\text{--}17.6 \mu\text{m}$; (2) oxyasters with about 10–20 roughened to irregularly spined rays, centrum mostly below 24%, with relatively rare strongylasters of similar size, with some rays tylote, centrum occasionally up to 45%, diameter $8.9\text{--}12\text{--}14.6 \mu\text{m}$.

Remarks. It is possible that the partly corroded vermetid shells functioned as excurrent canals and oscules. My synonymy is based on that suggested by Bergquist (1969: 69), and my identification is

based on the discussion therein, from which *Jaspis stellifera* emerges as a rather polymorphic species. Some of Bergquist's points need to be corrected or clarified. Neither Carter (1879b) nor Sollas (1888) mentioned that the asters in *J. stellifera* are tylasters. Carter's primitive figure can only be interpreted as a strongylaster. *Stellettinopsis carteri*, as described by Ridley (1884a), does not have identical microscleres: Carter and Sollas give $17 \mu\text{m}$ diameter for *J. stellifera*, Ridley gives $50 \mu\text{m}$ for *S. carteri*. Diameters of asters given by Carter and Sollas are $8.3 \mu\text{m}$ for *S. tuberculata*, and $18 \mu\text{m}$ for *S. lutea*, hence the latter are not "much smaller" than in *J. stellifera*, and those of *S. tuberculata* are near the lower extreme in the specimen examined. The Australian species of *Jaspis* urgently need revision, as none of the primary types involved have been re-examined since the original descriptions. Sollas merely gave résumés with spicule dimensions converted to metric. Carter gave only single measurements (commonly the largest observed) with no or little regard for ranges. Since the smallest oxea in the specimen examined fall into the range of the "microxea" in *Stellettinopsis coriacea* and *S. purpurea* Carter, it is not unlikely that Carter overlooked intermediate sizes, that the latter two species might have to be merged in *Jaspis stellifera*, and that this species is perhaps more polymorphic in southern than in northern Australia.

Order Spirophorida Brien, 1968

Tetillidae Sollas, 1886

Tetilla Schmidt

Tetilla Schmidt, 1868: 40. — Sollas, 1888: cxxiv, 1 (definition). — Lendenfeld, 1903: 16 (review with résumés). — Dendy, 1905: 89 (definition). — Wilson, 1925: 355 (definition, résumé, discussion, list of species). — Bergquist, 1965: 197f (discussion). — Bergquist, 1968: 60 (Southern Ocean species).

Chrotella Sollas, 1886: 180. — Sollas, 1888: cxxv, 17 (definition). — Lendenfeld, 1903: 16 (synonymised with *Tetilla*). — Burton, 1937: 11 (synonymised with *Cinachyra*). — Burton, 1959: 200 (synonymised with *Cinachyra*).

Diagnosis. Hemispherical to globular Spirophorida without vestibular calices, and without modified triaenes. Small oxea, if present, not spiny and not in cortical layer. Sigmaspires present.

Tetilla praecipua sp. nov.

Plate 2 figures 3, 4, plate 21 figure 1, text-figure 18

Holotype: NMV F51943, Bass Strait, 17 km S of Warrnambool, $38^{\circ}32.0'S$, $142^{\circ}28.6'E$, depth 52 m, coarse sand and shells (stn BSS 187).

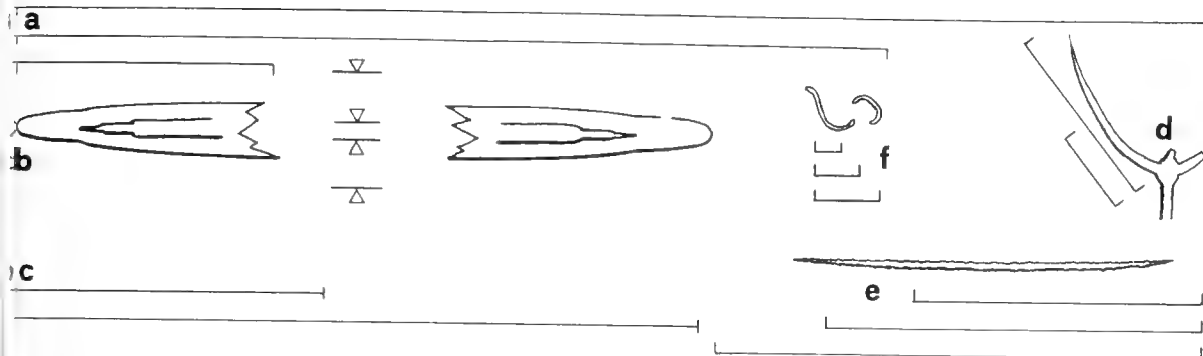


Figure 18. *Tetilla praecipua* sp. n., spicules. a. Range of oxea, $\times 34$. b. Enlarged ends of oxea and range of thickness, $\times 329$. c. Range of triaenes, $\times 34$. d. Enlarged cladome, $\times 329$. e. Microxea, $\times 329$. f. Sigmaspire, $\times 329$.

Diagnosis. Small, roughly hemispherical, firm. Surface hispid, orange-yellow with greenish grey on sides. Small, clustered oscules. No distinct cortex. Radial choanosome with conspicuous terete canals regularly arranged, thick megascleres in bundles, interstitial microxea in confusion, and faint sigmaspire. Prottriaenes rare, atrophied; no anatriaenes.

Description. Torn off from base, slightly damaged top. Dome-shaped, with humped top. Diameter at base 6 cm, height 4 cm. Firm, moderately compressible. In life dull orange-yellow with mixture of greenish-gray on sides (7.5 YR6-7/10). Surface from faintly hispid on top, to distinctly hispid (spicule plush 0.5-1 mm) on sides, with foreign debris, small algae and hydroids. Two symbiotic barnacles imbedded on one side. Small oscules, 0.2-0.5 mm wide, clustered in irregular fields, chiefly on one side of apical hump. Excurrent canals terete, straight, annulate, mostly around 1 mm wide; radial and oblique, regularly spaced. No distinct cortex. Radial arrangement of megascleres. Thinner megascleres (oxea) commonly single, slightly spaced; thicker ones mostly in bundles 140-350 μm wide, between radial canals. Throughout choanosome scattered to felted microxea or rhabdids. Thin sigmaspire numerous. Triaenes rare, cladomes atrophied, commonly as promonaenes. No triaenes in inner (focal) choanosome; no anatriaenes anywhere.

Spiculation: (1) Oxea, straight or bent in the middle, regular, with blunt, mucronate or telescoped tips, $910-3065-4182 \times 4.7-26.1-41.5 \mu\text{m}$; (2) triaenes, much atrophied, mostly as promonaenes, occasionally as tylostyles, with fusiform rhabdids thickest in the middle, clads occasionally subterminally irregularly polytylote, rhabdids $1093-2409 \times 2.8-4.1 \mu\text{m}$, clads $30.7-67.6 \mu\text{m}$; (3) microxea or rhabdids, roughened, straight or gently curved to slightly flexuous,

$104.7-137.2-176.5 \times 1.0-1.6-2.0 \mu\text{m}$; (4) sigmaspire, $9.5-17.2-24.4 \mu\text{m}$ chord, about $0.8 \mu\text{m}$ thick.

Remarks. *Tetilla praecipua* falls within the small group of species having small oxea scattered throughout the sponge. The three species of this group then known, *Tetilla monodi* Burton (1956) from West Africa, *T. oxeata* Burton (1959), from South Arabia, and *Tetilla microxea* Bergquist, from the Caroline Islands, were discussed in Bergquist (1965: 197). *Tetilla praecipua* is closest to *T. microxea* in spicule measurements, rarity of triaenes and atrophied cladomes of prottriaenes. *Tetilla microxea* differs from *T. praecipua* in colour, in possessing conules and long spines of oxea projecting from the surface, and in the presence of anatriaenes.

Order Hadromerida Topsent, 1894

Tethyidae Gray, 1867

Tethya Lamarck

Tethya Lamarck, 1814 (1814-1815): 69 (in part). — Lindgren, 1898: 358f (revision). — Burton, 1956: 120. — Burton, 1959: 214 (synonymy, discussion). — Bergquist, 1968: 37 (discussion). — Wiedenmayer, 1977a: 170 (synonymy, references).

Diagnosis. Commonly globular Tethyidae, with distinct cortical and choanosomal types of euasters.

Tethya ingalli Bowerbank

Plate 2 figures 5, 6, 9, plate 21 figure 2,
text-figure 19

Provisional synonymy.

Tethya ingalli Bowerbank, 1859: 307, pl. 25 figs 12, 14. — Bowerbank, 1872: 119, pl. 5 figs 11-17 (Fremantle, WA) — Vosmaer, 1932-1935: 192 (résumé).

Tethya ingalli. — Ridley, 1884b: 624 (discussion). — Sollas 1888 431, pl. 44, figs 15, 16 (Bass Strait, Port Jack-

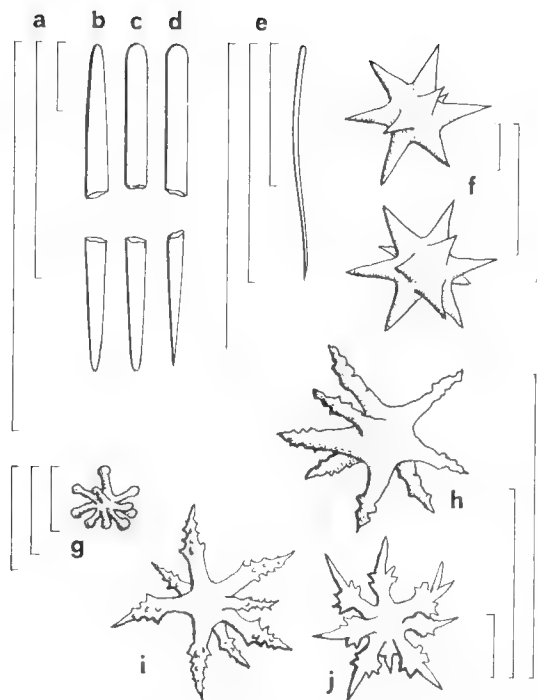


Figure 19. *Tethya ingalli*, spicules. a. Range of principal megascleres., $\times 27$. b-d. Enlarged tips of principal megascleres, $\times 263$. e. Cortical styles, $\times 68$. f. Oxsypheasters, $\times 263$. g. Tyasters, $\times 790$. h-j. Choanosomal asters, $\times 790$.

son). Lendenfeld, 1897a: 18 (synonymy). — ?Kirkpatrick, 1900a: 132 (Christmas Island). — Topsent, 1918: 578, 579, 600 (résumé, discussion, synonymised with *Donatia diploderma* (Schmidt), other synonyms). — Burton, 1924b: 1039 (holotype re-examined, synonymised with *Donatia diploderma*). — Bergquist, 1968: 36, pls 5b; 13c, e (synonymy, description, discussion; New Zealand).

nec *Tethya ingalli*. — Lindgren, 1898: 317, 360 (= *Tethya seychellensis* fide Hechtel, 1965: 65).

?*Donatia ingalli*. — Hentschel, 1909: 371 (= ? *Tethya seychellensis*).

Donatia ingalli. — Hentschel, 1912: 316 (Aru Islands, Indonesia).

nec *Donatia ingalli*. — Dendy, 1916a 264, pl. 48 fig. 3 (= *Tethya robusta* Bowerbank, fide Burton, 1924b).

Donatia ingalli var. *maxima* Hentschel, 1909: 372 (Shark Bay, WA). — Topsent, 1918: 598 (discussion). — Burton, 1924b: 1039 (synonymised with *Donatia diploderma*).

Tethea cliftoni Bowerbank, 1873a: 16, pl. 3, figs 14–18 (Fremantle, WA). — ?Carter, 1886b: 122 (Port Phillip Heads, Vic.). — Sollas, 1888: 431 (holotype re-examined, synonymised with *T. ingalli*). — Topsent, 1918: 583 (résumé, discussion, synonymised with *Donatia diploderma*). — Burton, 1924b: 1039 (holotype re-examined, synonymised with *Donatia diploderma*). — Vosmaer, 1932–1935: 195 (résumé).

?*Tethya cliftoni*. — Ridley, 1884b: 624 (discussion; Seychelles).

Tethya inflata Lendenfeld, 1888: 49 (Port Jackson). — Lindgren, 1898: 360 (discussion). — Hallmann, 1914a: 275 (syntypes redescribed, as *Donatia ingalli* var. *laevis* (Lendenfeld). — Topsent, 1918: 590 (discussion). — Vosmaer, 1932–1935: 197 (résumé, discussion).

Tethya phillipensis Lendenfeld, 1888: 50 (Port Phillip Bay, Vic.). — Lindgren, 1898: 360 (discussion, synonymised with *T. ingalli*). — Hallmann, 1914a: 277, pl. 15, fig. 4 (syntypes redescribed as *Donatia phillipensis*). — Topsent, 1918: 579, 590, 650, 601 (résumé, discussion, synonymised with *T. diploderma*). — Burton, 1924b: 1039 (syntype in BMNH re-examined, synonymised with *Donatia diploderma*). — Vosmaer, 1932–1935: 198 (résumé).

Tethya laevis Lendenfeld, 1888: 51 (Port Jackson). — Lindgren, 1898: 360 (discussion, synonymised with *T. ingalli*). — Hentschel, 1909: 372 (remark). — Hallmann, 1914a: 281 (syntypes redescribed, as *Donatia ingalli* var. *laevis*, includes *Tethya ingalli*: Sollas). — Topsent, 1918: 591 (discussion, synonymised with *T. diploderma*). — Burton, 1924b: 1039 (syntype in BMNH re-examined, synonymised with *Donatia diploderma*). — Vosmaer, 1932–1935: 197 (résumé, discussion).

?*Donatia parvistella* Baer, 1906: 31, pl. 2 fig. 9; pl. 5 figs 35–38 (Zanzibar). — Dendy, 1916a: 262 (synonymised with *Donatia japonica*). — Topsent, 1918: 598, 601 (discussion, synonymised with *Donatia diploderma*). — Burton, 1924b: 1039 (synonymised with *Donatia diploderma*).

Donatia japonica varr. *nucleata* and *globosa* Hentschel, 1909: 372, text-fig. 11; 373, text-fig. 12, pl. 22 fig. 8 (WA between Shark Bay and Albany). — Hentschel, 1912: 317 (types re-examined, synonymised with *Donatia ingalli*). — Topsent, 1918: 598 (résumé, discussion).

Donatia diploderma. — Topsent, 1918: 574, 600, text-figs 22–24 (part, discussion, description of new records; Gulf of Aden?; Ambon, Indonesia?). — Burton, 1924b: 1039 (part). — ?de Laubenfels, 1936b: 451 (Pacific end of Panama Canal). — Guiler, 1950: 9 (Tasmania, identified by Burton). — ?de Laubenfels, 1950a: 30, text-fig. 20 (Hawaii). — ?de Laubenfels, 1954a: 232, text-fig. 160 (Marshall Islands). — ?de Laubenfels, 1955a: 141 (Gilbert Islands). — Lévi, 1956b: 7, text-fig. 4 (fide Bergquist, 1968; Madagascar).

Tethya multistella. — Bergquist, 1961b: 193, text-fig. 16a, b (nec Lendenfeld; New Zealand).

Material examined. Station KG 1, one specimen (F51944). Type specimens of *Tethea ingalli*, *T. cliftoni* (BMNH); of *Tethya inflata*, *T. phillipensis*, *T. laevis* (AM).

Diagnosis. Globular, small to medium-sized; commonly thin pedicels variable in number (up to 10) and length. Very firm, leathery. Surface smooth to moderately but irregularly tabuerculate, pale red to pink or dull orange. Cortex thick (2.5–3 mm), dense, orange-buff, traversed by regular radial pillars of megasclere bundles and of oxsypheasters expanding into outer cortex with packed oxsypheasters; hence regular arcade-like cortical structure in sections. Large oxsypheaster of cortex and

peripheral choanosome regular, massive, mostly with 12 conical rays.

Description. Globular, slightly ellipsoidal, 4–4.5 cm in diameter. 10 pedicels around base, 3–20 mm long, 1–4 mm thick. Surface in life pale red to pink (5–7.5 R8/10). After preservation dull red-orange (10 R6/10 to 2.5 YR7–8/6) top and outer cortex, orange-buff (5 YR9/4) base and inner cortex. Choanosome in first alcohol dull orange-yellow (7.5 YR7/10 to 2.5 Y8/8). Very firm, little compressible, leathery. Surface mostly smooth, except one side and top, with either faint polygonal tubercles (2 mm wide) separated by narrow grooves, or a pitted and rugo-reticulate pattern (pits and rugae 0.5–1 mm wide). No oscules.

Cortex 2.5–3 mm thick, of two layers. Outermost thin hyaline ectochrote, 30–35 μm thick, with packed tylasters. Outer cortex 2 mm thick, very collagenous, coarsely but vaguely fibrous. Few radially oriented fibres clearly visible. Inner cortex radially traversed by pillars of crowded to packed oxyspherasters. Pillars mostly 300–350 μm wide proximally, expand distally, in joining outer cortex. General aspect of an arcade. Equally frequent, but more irregularly spaced between pillars of spherasters, also radial, are columns of oxea, in width generally inferior to pillars of spherasters. Oxea-columns issue from choanosome, surrounded in periphery by receding sheaths of cortical matrix. Columns compact through choanosome and most of inner cortex; expanding towards outer cortex, then often looser, branching through outer cortex, ending flush with surface. Interstices of inner cortex contain some radial lines of crowded spherasters and tylasters, commonly mixed. Width of these lines equals that of 1–3 spherasters. Some columns of oxea surrounded by scattered asters. Spherasters rare elsewhere in inner cortex, but tylasters scattered throughout. Chones indistinct, probably coinciding with radial lines of crowded asters. One pillar of spherasters contains an excurrent canal. Inner cortex also contains subradial styles and styloids, irregularly flexuous, hastate to slightly fusiform, most common below outer cortex, single or in groups of 2–3, pointed ends outwards. Ends blunt, mucronate, or conical to variable length, frequently embedded in outer cortex. Some with bases in peripheral choanosome.

Choanosome packed (periphery) to crowded with asters of three categories: two like in cortex, less frequent inward; third, more abundant inwards, oxyasters with thin, distally microspined rays. Compact radial columns of oxea, 180–200 μm wide, equally distant, issue from small focal area of packed megascleres. One half of columns expand,

merge, overlap, and end below cortex, remainder traverses cortex.

Spiculation: (1) Oxea, fusiform, straight, mostly as anisostrongyloxea, with blunt tips, some modified to styloids, strongyles, rarely styles, 310–1048–1733 \times 4.1–11.7–17.4 μm . (2) Styles of cortex, variably flexuous, 249–425–548 \times 4.2–6.4–8.2 μm . (3) Oxyspherasters with 12–16 massive, conical rays; in spicular slides, most common meristic form has six rays in focal plane and three oblique rays on top; diameter 20.9–60.3–72.4 μm , centrum 26–32–40%. (4) Tylasters with 6–12 rays, mostly stocky occasionally slender, more numerous in cortex; diameter 9.9–13.6–16.1 μm , centrum 17–28%. (5) Oxyasters of the choanosome, centrum small or absent, with 6–10 slender, commonly crooked and distally spined rays: proximal parts of rays frequently straight, distal, spined parts deviate at a low angle, or curved. Many forms show spines decreasing in length from middle of ray; initial, strongest spines may coincide with a tyle. Some rays branch at this point; branches mostly uneven in length and thickness. Some transitional forms to tylasters, with stocky rays; some or all tyles in shape of flowers (anthasters), from which one stronger spine or spiny actinal branch may issue. Diameter 9.6–29.3–47 μm .

Remarks. The synonymy given above is tentative and follows that suggested and discussed by Bergquist (1968: 36). But some further comments seem appropriate. *Donatia ingalli* sensu Dendy (1916a: 264) is a misidentification of *Tethya robusta* Bowerbank, as Burton (1924b) correctly pointed out. This also explains Dendy's following comment under *Donatia seychellensis* (1916a: 265): "The large red *Donatia* so common in the neighbourhood of Port Phillip, Victoria [the true *Tethya ingalli*], possesses large oxyasters very similar to those of *D. seychellensis*, but I am inclined to think, on account of other characters, that it is specifically distinct both from *D. seychellensis* and *D. ingalli*." Indeed the whole spiculation of *Tethya ingalli* is very similar to that of *T. seychellensis*, as Hechtel's detailed description (1965: 65) makes clear. The cortical structure of the new specimen is sufficiently similar to that represented in Sollas (1888, pl. 44 fig. 16) to justify the specific separation of *T. ingalli* and *T. seychellensis* in the sense of Sollas and Hechtel.

As to *Tethya diploderma*, I concur with Hechtel (1965: 66) that the species must be considered as unrecognisable at present. There is, however, a type-slide extant in the British Museum (Natural History), BMNH 1870.5.3.93, cabinet 2, tray 52.

Burton (1924b: 1039) re-examined it, but gave no details. Sollas' brief and insufficient redescription (1888: 439) is probably based on this slide. Topsent (1918: 574f.) was unaware of its existence. No complete survey of Schmidt's type material has ever been published. This applies particularly to the Atlantic material of 1870 (Museum of Comparative Zoology; unpublished survey by W.D. Hartman, Peabody Museum); to his material in the Copenhagen Museum, and his collections of types, schizotypes and slides in the Landesmuseum Joanneum, Graz, Austria. The specimens of the latter collection are now temporarily in Geneva, curated by R. Desqueyroux-Faundez, and partly being revised by her and by J.N.A. Hooper (personal communication).

Unfortunately, many published records and short descriptions of Indo-Pacific sponges, assigned to *Tethya ingalli*, *T. seychellensis*, and *T. diploderma*, are dubious.

Polymastiidae Gray, 1867

Polymastia Bowerbank

Polymastia Bowerbank, 1863c: 1104.—Ridley and Dendy, 1887: 210.—Dendy, 1922: 148 (definition).—

Burton, 1930c: 670 (definition, discussion).—Bergquist, 1968: 21, 24 (key to New Zealand species).

Diagnosis. Encrusting to massive, sessile Polymastiidae; papillae variable in number and length; without marginal fringe of radial spicules. Tylostyles, subtylostyles, styles and styloids commonly in three sizes. Pronounced cortex with tangential and radially bundled spicules, smallest megascleres in palisade at surface. Chiefly littoral and sublittoral.

Polymastia crassa Carter

Plate 2 figures 7,8, plate 21 figures 3–5,
text-figure 20

Polymastia bicolor var. *crassa* Carter, 1886b: 120 (Port Phillip Heads, Vic.).

Polymastia crassa.—Dendy, 1897: 250 (2 syntypes re-examined, new records from Port Phillip Heads).

Material examined. Station KG 7, two specimens (F51945, F51946); station WB, one specimen (F51947). Type specimens of *Polymastia bicolor* var. *crassa* (BMNH).

Diagnosis. Base thin, encrusting; numerous papillae variable in width, low to moderately high (mostly 5–20 mm), often contorted, irregular, wrin-

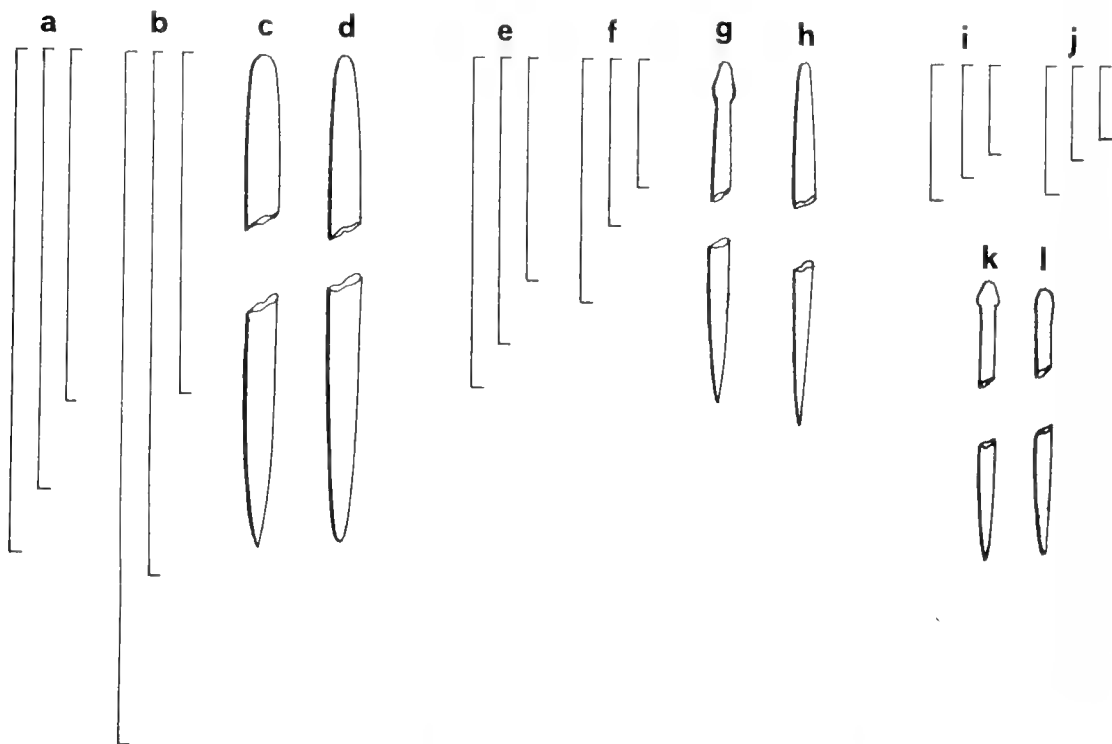


Figure 20. *Polymastia crassa*, spicules. a–b. Ranges of large styles, from F51945 and F51946, respectively, $\times 85$. c–d. Enlarged ends of large styles, $\times 329$. e–f. Ranges of medium styles, as for a–b, $\times 85$. g–h. Enlarged ends of medium styles, $\times 329$. i–j. Range of small styles, as for a–b, $\times 85$. k–l. Enlarged ends of small styles, $\times 329$.

kled, some with apical oscules. Firm, little compressible. Surface otherwise smooth. Colour variable, papillae commonly orange, base greyish orange, to reddish or dark purple, the latter occasionally on whole sponge. Interior pale orange to yellow. Cortex 0.7–1.5 mm thick, with palisade of small styles at surface. Deeper cortex may be vaguely stratified by layers of paratangential spicules. Choanosome dense, with spicules in confusion and in ascending bundles; these branch in periphery, and often traverse cortex in umbels. Walls of papillae reinforced by longitudinal spicular bundles.

Description. Largest specimen (F51945, pl. 2 fig. 7) pear-shaped in outline, 9 × 12 cm wide, 3 cm high. Papillae crowded, stubby, with interstices equal to their width or narrower. Papillae smaller on sides, 1–5 mm wide and high, larger (5–20 mm wide and high) in median zone. Many papillae confluent, compressed and vermiculate in section; larger ones bear longitudinal folds and wrinkles, and are mostly inclined to recumbent. Apical oscules rare on small papillae, more frequent on larger ones.

In life salmon to orange on papillae (10 R – 2.5 YR7/8–10), greyish red around base (5 R6/2–3), with pale orange to yellow (10 YR – 2.5 Y8–9/6–10) in cortex and choanosome. Firm, little compressible.

Specimen F51946 (pl. 2, fig. 8) growing on sand, encrusting base of indented outline, 2–3 mm thick, 7 × 5 cm wide. 21 mostly tapering papillae more widely spaced than in larger specimen, often compressed, 2–8 mm wide at the base, up to 15 mm long. Some weakly rugose longitudinally, mostly recumbent in different directions, contorted. Some bear minute apical oscules. Base incrustured with sand. Papillae bright orange (2.5 YR7/12), base greyish orange (2.5 YR7/3). Rubbery.

Specimen F51947 similar in shape to F51946, but smaller: base 3 × 4.5 cm wide, 1–2 mm thick. Papillae crowded, not above 3 mm wide at the base, 5 mm long. Very dark purple, almost black, throughout (5 RP3/1). Now (in alcohol) dull yellowish brown (10 YR5–6/3–4), other two specimens now cream-coloured. Cortex in largest specimen 1–1.5 mm thick in base, 700–870 µm in intermediate specimen. Choanosomal skeleton, in former, of closely spaced subparallel columns, 40–180 µm thick, of large megascleres. They frequently branch and anastomose obliquely; some break up into disorderly bundles. Interstitially crowded intermediate spicules, some larger spicules in confusion. Below cortex, spicular columns branch more regu-

larly and in cortex expand to form confluent to overlapping umbels. Pattern may be obscured or replaced by large spicules in confusion. Outer cortex formed by palisade of small spicules.

Matrix of cortex finely fibrous, mostly without orientation, much lighter, in transmitted light, than choanosome. Contrast accentuated by interstitial confused spicules in choanosome, and by abundance therein, of minute, vesicular to elongate and contorted (sausage-shaped) bodies, presumably algal symbionts. They also occur in cortex, but much less profusely. Between spicular columns, boundary with cortex usually bulges outward, with sheaths of cortical matrix penetrating deeply along columns.

Skeletal structure in intermediate specimen somewhat different: spicular columns more distinct, more widely spaced, their branching in peripheral choanosome and expansion in umbels in cortex more regular. Interstitial confused spicules paratangential in periphery. Second layer of paratangential spicules below outer 3/5 of cortex. Cortex in papillae only 330 µm thick, spicular columns more crowded than in base. Boundary with cortex rarely bulges between spicular columns.

Spiculation (individual measurements): F51945: (1) Large styles, strongyles, strongyloxea (styloids), 492–611–699 × 7.1–10.7–16.2 µm. (2) Medium styles, subtylostyles, strongyloxea (distinction from the large spicules is somewhat arbitrary, but intermediate sizes are rare), 311–401–462 × 5.6–7.4–9.1 µm. (3) Small styles and tylostyles, 124–158–188 × 2.4–4.2–5.3 µm. F51946: (1) Large styles, strongyles, strongyloxea (styloids), 477–730–964 × 7.6–11.4–15.3 µm. (2) Medium styles, tylo- and subtylostyles (with small heads), oxea, 179–232–340 × 4.7–7–9.1 µm. (3) Small tylostyles, 100–129–177 × 1.9–2.9–4.4 µm.

Remarks. Carter (1886b: 119, 121) also described *Polymastia bicolor* (as typical variety) and *P. masalis* from Port Phillip Heads. Dendy (1897: 249–250), who re-examined the types of both, regarded the latter as a variety of *P. bicolor* and doubted that this species belongs to *Polymastia*, stating: "It appears to be intermediate in structure between the genera *Suberites* and *Polymastia*." I have not examined these types (BMNH), particularly the type slides, and cannot comment on this issue. Of the four species described by Bergquist (1968), three are known from New Zealand only, *P. conigera* Bowerbank also from Britain and from the Indian Ocean. The latter is spherical with a single osculiferous papilla. *P. hirsuta* Bergquist has a surface pile and involute papillae. *P. fusca* Berg-

quist and *P. granulosa* Brøndsted are closer to *P. crassa* in shape and surface, but have a distinct, uniform colour: dark chocolate brown externally in *P. fusca*, mostly conserved after fixation, deep orange throughout in life in *P. granulosa*. *P. fusca* also differs from *P. crassa* in cortical structure (packed with spicules, small subtylostyles often exotylote), while in *P. granulosa* the large subtylostyles are commonly polytylote.

Spirastrellidae Ridley and Dendy, 1886

Spirastrella Schmidt

Spirastrella Schmidt, 1868: 17. — Wilson, 1925: 345 (discussion). — Bergquist, 1965: 185 (discussion). — Wiedenmayer, 1977a: 162 (synonymy in part, not *Spirastrella*, = *Diplastrella*; references).

Diagnosis. Incrusting to massive Spirastrellidae of variable, often irregular shape. Tylostyles and subtylostyles, subordonately styles, in more or less isolated ascending bundles. Spirasters mostly coarse, scattered to packed in choanosome, often concentrated in superficial crust, absent in some specimens. Boring assumed in two species. Colour in life commonly yellow, brown, grey or deep purple, never blackish.

Remarks. This genus is notoriously difficult and controversial in taxonomy, especially in delimitation of species. Vosmaer's (1911) extreme lumping was criticised by several authors (notably Hallmann, 1914a: 291f.; Topsent, 1918: 542f.; Wilson, 1925: 345).

Of the species recorded from southern Australia, *S. purpurea* (Lamarck), with synonyms *S. wilsoni* (Carter) and *S. bonneti* Topsent, and redescribed by Topsent (1918: 546; 1933: 43), is distinct chiefly by its deep, stable purple colour (spongioporphyryne; see Bergquist and Skinner, 1982, pl. 7 fig. 3). Its thick cortex is differentiated into an inner zone of felted megascleres, and an outer zone of packed spirasters and erect megascleres. Spirasters are mostly small, feebly spiral, often approaching amphiasters. In some specimens, microscleres may be rare or lacking, and most megascleres may be modified or reduced, often with subterminal tyles or without tyles (with styles and even strongyles resulting). Sand is commonly incorporated throughout the sponge body. The presence of *S. cunctatrix* in southern Australia needs to be confirmed, but is not unlikely from its known distribution (Western Atlantic, Mediterranean, Indo-West Pacific [see Desqueyroux-Faundez, 1981: 733], North Australia [as *Spirastrella decumbens* Ridley], Hawaii, Gulf of California).

S. areolata Dendy (1897: 255) may well be a good species, characterised by a regular polygonal-areolate surface (Vosmaer, 1911, pl. 3 fig. 4). This pattern is reminiscent of *Raphyrus hixoni* Lendenfeld (1885) described from Sydney.

S. digitata Hentschel (1909) seems to be sufficiently distinct by its shape, colour (orange-brown surface, whitish choanosome) and ecology. *S. massa* Ridley and Dendy (1886) (holotype from Bass Strait, BMNH 1887.5.2.33, not examined by me) is described as massive, pale yellow, with very diffuse skeleton, and commonly slender spirasters with up to six bends. Vosmaer (1911: 17), who re-examined the holotype, regards it as very close to *S. wilsoni* (correctly *S. purpurea* sensu Topsent), except for colour. It may therefore be conspecific with *Suberites wilsoni* var. *albidus* Carter (holotype: BMNH 1886.12.15.256; spirasters figured by Vosmaer, 1911, pl. 12 fig. 3). This species, if future revision based on primary types and topotypes should confirm its validity, would have to be called *Spirastrella albida* (Carter). *Suberites spirastrelloides* Dendy (1897) is probably another synonym. Vosmaer (1911: 23) observed "traces of red color" on the holotype of *Suberites wilsoni* var. *albidus*. The possibility should not be excluded that purple and yellowish or brownish specimens occur within one species (*S. purpurea*), with transitions, as this seems to be the case in the Japanese *Spirastrella panis* Thiele, as redescribed by Hoshino (1981: 224).

S. spinispirulifera (Carter), first described from South Africa, then from Victoria, Indonesia and New Zealand (Bergquist, 1968: 16) is sufficiently distinct by its weakly spined spirasters (spinispirae).

A number of species from the Indo-West Pacific region have been described up to 1905 (*S. punctata* Ridley, *S. vagabunda* Ridley, *S. solida* Ridley and Dendy, *S. inconstans* (Dendy), *S. transitoria* Ridley, *S. cylindrica* Kieschnick, *S. aurivillii* Lindgren, *S. semilunaris* Lindgren, *S. carnosa* Topsent, *S. lacunosa* Kieschnick, *S. spiculifera* Kieschnick, *S. tentorioides* Dendy) which might be good species. This applies particularly to those redescribed more recently: *S. vagabunda* and *S. aurivillii* by Bergquist (1965: 182f.); *S. inconstans* by Vacelet et al. (1976: 33); *S. carnosa* and *S. solida* by Desqueyroux-Faundez (1981: 734). Vacelet et al. (1976: 34) have shown that species in the *inconstans-vagabunda* group, with similar and variable morphology, can be distinguished in the field by their ecological affinities, though attribution to any of the old species remains problematical. Their species 1 prefers back-reef habitats (sand flats with sea-grass, mangroves); their species 2 occurs in shaded and sheltered recesses in shallow portions

of the coral reefs; their species 3 inhabits somewhat deeper portions of the fore-reef. *S. aurivillii*, as redescribed by Bergquist (1965), besides containing characteristic spirasters, has a predominantly boring habit, largely hidden in fairly large cavities in coral rock, with papillae protruding through straight channels.

Spirastrella papillosa Ridley and Dendy

Plate 2 figures 10, 11, plate 21 figure 6,
text-figure 21

Spirastrella papillosa Ridley and Dendy, 1886: 491. — Ridley and Dendy, 1887: 232, pl. 41 fig. 5, pl. 45 fig. 11 (Port Jackson). — Dendy, 1897: 253 (synonymy; Port Phillip Bay). — Whitelegge, 1897: 331 (Funafuti). — Vosmaer, 1911: 17, 33, 41, 56, 60, 61 (references, résumé, type data, description, discussion). — Hallmann, 1912: 126 (Shoalhaven Bight, Port Jackson, NSW, Port Phillip Bay).

Cliona papillosa. — de Laubenfels, 1936a: 142 (transfer only).

Spirastrella papillosa var. *porosa* Dendy, 1897: 253 (Port Phillip Heads). — Vosmaer, 1911: 17 (discussion).

Spirastrella cunctatrix. — Carter (nec Schmidt), 1886b: 114 (part, only BMNH: 1886.12.15.250, Port Phillip Heads, figured in Vosmaer, 1911, pl. 3 fig. 3, pl. 10 fig. 2).

Spirastrella cunctatrix var. *porcata* Carter, 1886b: 115 (Port Phillip Heads). — Vosmaer, 1911: 10, 27, 33, 39, 61 (references, résumé, type data, description, discussion), pl. 10, fig. 3 (spicules of holotype).

Papillina panis Lendenfeld, 1888: 58 (part, not pl. 1 figs 1, 2, fide Hallmann, 1914a; Port Jackson). — Whitelegge, 1889: 181. — Hallmann, 1914a: 294 (syntypes redescribed).

Spirastrella purpurea. — Vosmaer (nec Lamarck), 1911: 17 (part, specimens S.E. 426d, 92a-l only), pl. 3 fig 5, pl. 4 fig. 3, pl. 9 fig. 6, pl. 10 fig. 1, pl. 14 fig. 1. (Selat Sape, Flores Sea, Indonesia).

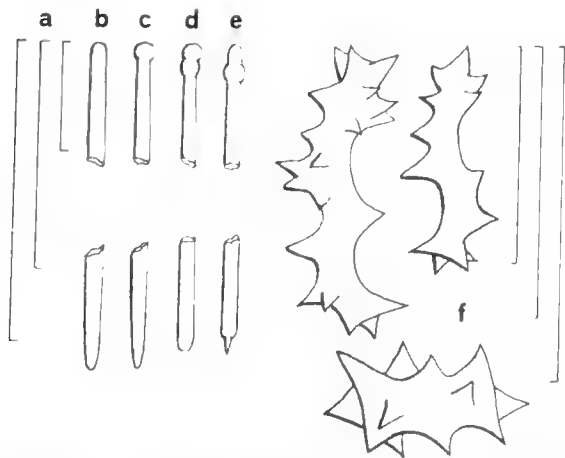


Figure 21. *Spirastrella papillosa*, spicules from F51948. a. Range of megascleres, $\times 68$. b-c. Enlarged ends of megascleres, $\times 263$. f. Spirasters, $\times 790$.

Material examined. Station KG 10a, one specimen (F51948); station BSS 187, two specimens (F51949, F51950). Holotypes of *Spirastrella papillosa* and of *Spirastrella cunctatrix* var. *porcata* (BMNH); type specimens of *Spirastrella papillosa* var. *porosa* (NMV) and of *Papillina panis* (AM). Hypotype of *Spirastrella cunctatrix*: Carter (BMNH 1886.12.15.250).

Diagnosis. Shape variable, often massive, like turtle-shell, also thickly flabellate, radially folded, with wide, truncate margin containing regular depressions. Firmly spongy. Oscules marginal. Surface except margins commonly nodulose or papillate, but this relief sometimes subdued; otherwise smooth. Deep yellow, olivaceous or purplish grey, internally light yellowish brown or dark olive-grey. Cortex 0.7–2.5 mm thick, full of felted megascleres, more crowded (packed) at surface, as for spirasters. Choanosome finely and regularly cavernous, with felted megascleres mostly in thin contorted walls. Spirasters intermediate in size (for genus), rather robust, shafts often straight, terete.

Description. Shape and size of first specimen (pl. 2 fig. 10) like figure in Ridley and Dendy (1887, pl. 41 fig. 5). Roughly pear-shaped, $11 \times 15 \times 8$ cm; flat base of attachment almost circular in outline, 9 cm in diameter. Most of free side covered with crowded round papillae, 5–8 mm in diameter, 2–3 mm high. Two blunt conical elevations on top, and on one side near base, respectively. Papillae in upper half tend to be aligned longitudinally, and coalesce in apices of osculiferous cones, passing into longitudinal folds separated by narrow furrows. Apical oscules, now closed, have deeply incised, irregularly stellate margins. Deep yellow in life (10 YR to 2.5 Y8/20) on outer surface, light yellowish brown (7.5 YR7/4–6 and 7.5 YR8/4–8) around base and in choanosome.

Other two specimens thickly flabellate. F 51949 (pl. 2 fig. 11) 2.5 cm thick near base, 1.5 cm distally. Width and height 14–15 cm. Free margin three-quarters-circular in outline, truncate with several contiguous squarish depressions. Small oscules situated partly in these depressions, partly irregularly scattered on one side. Papillae on both sides smaller, more numerous, lower than in F51948, often vague and coalescent. One side coarsely corrugated longitudinally. Olive in life. F51950 a section (about one-third) of irregularly crescent-shaped lamella, 18 cm wide, 10–11 cm high, up to 5 cm thick at base. Both surfaces more vaguely and irregularly nodulose than in previous specimen. Surface purplish slate-grey, dark olive-grey in choanosome. All specimens firmly spongy, internally finely cavernous.

Cortex variable in thickness, 700 μ m in F51948, 2.5 mm in F51949, 1 mm in F 51950. Full of felted

megasccleres, with microsccleres scattered in lower half to three-quarters, crowded further out (zone commonly pigmented), packed at surface. Surface layer, 80–170 μm thick in F51949, not always distinct, often with still felted megasccleres, either flush with surface or protruding from it. In F51950 spirasters gradually decrease in abundance from surface to middle of cortex. Foreign debris widely scattered throughout choanosome and cortex in two flabellate specimens. In massive specimen choanosome often packed with sand, while cortex contains very few grains.

Spiculation (in F51949): (1) Tylostyles, subtylostyles and styles, straight, curved or bent; with tyles frequently subterminal, faint, or composite, occasionally tilted, or with second, faint subterminal tyle; points may be telescoped, mucronate, stronglyloxeate or stronglylate; 184–384–510 \times 2.6–6–8.4 μm . (2) Spirasters mostly straight to gently twisted, occasionally curved or bent, irregularly or spirally spined, with distinct terete shafts, total length 32.1–40.1–49.4 μm , width of shaft 2.8–3.7–4.5 μm , width with spines 10.2–15.1–19.3 μm .

Remarks. In morphology, the spicules in the new specimens, particularly the microsccleres, compare well with pl. 10 figs 2, 3 in Vosmaer (1911), representing those in Carter's two specimens from Port Phillip Heads, quoted in synonymy above, and with pl. 45 fig. 11 in Ridley and Dendy (1887). Of the measurements tabled in Vosmaer (1911: 61), and based on re-examination of the type specimens, those for the Victorian specimens (B.M.1, B.M.10) again agree with mine (Dendy, 1897, gives 200–460 \times 4–8.3 μm for tylostyles, 50 \times 12 μm for microsccleres). In the holotype of *Spirastrella papillosa*, Vosmaer found maximum thickness of tylostyles to be 17 μm (Ridley and Dendy, 1887, give 15.7 μm), i.e. twice the size in my measurements. Vosmaer's own specimens from Indonesia (quoted in synonymy above) are comparable to the holotype from Port Jackson in dimensions of megasccleres (range: 183–600 \times 15–20 μm) and in the segregation of spirasters into two size-categories (22.5/55 μm in the holotype, 12.5–14/40–85 μm in Vosmaer's material). This may reflect a biogeographical gradient; but more material from Port Jackson and other localities will have to be examined.

Chondrillidae Gray, 1872

Remarks. Gray's name has priority over Chondrosiidae Schulze, 1877 (in the modern sense, with *Chondrilla* generally included) though the former

was less often used since its revival by de Laubenfels (1936a).

Chondrosia Nardo

Chondrosia Nardo, 1847b: 267. — Wiedenmayer, 1977a: 187 (synonymy, references).

Diagnosis. Chondrillidae without spicules.

Chondrosia reticulata (Carter)

Plate 3 figures 1–6, plate 22 figure 1

Halisarca reticulata Carter, 1886f: 274 (Port Phillip Heads and Westernport Bay).

Chondrosia spurca Carter, 1887a: 286 (Port Phillip Heads). — Carter, 1887c: 356 (synonymised with *Halisarca reticulata*). — Topsent, 1896b: 513 (synonymised with *Chondrosia collectrix* Lendenfeld). — Vosmaer, 1932–1935: 289 (résumé). — Wiedenmayer, 1977a: 188 (résumé).

Chondrosia reniformis forma *spurca*. — Burton and Rao, 1932: 324 (discussion, in part).

Chondrosia collectrix Lendenfeld, 1888: 74 (nec Schmidt, 1870; Port Jackson). — Hallmann, 1914a: 307 (redescription and discussion of holotype). — nec Brøndsted, 1926: 319 (a *Psammopemma* fide Bergquist, 1968: 63).

Reniera collectrix Lendenfeld, 1888: 78 (Port Jackson). — Whitelegge, 1902b: 277, 280 (redescription of 2 syntypes). — Hallmann, 1914a, b: 308, 327 (redescription of 2 syntypes, synonymised with *Chondrosia collectrix* Lendenfeld).

Chondrosia chucalla de Laubenfels, 1936a: 184 (nomen novum for *Chondrosia collectrix* Lendenfeld as secondary junior homonym). — ?de Laubenfels, 1951: 267 (Hawaii). — ?de Laubenfels, 1954a: 154, text-fig. 178 (Marshall Islands). — ?de Laubenfels, 1955a: 142 (Gilbert Islands).

Material examined. Station BSS 187, one specimen (F51951). Type specimens of *Halisarca reticulata* and *Chondrosia spurca* (BMNH). Type specimens of *Chondrosia collectrix* and *Reniera collectrix* (AM and BMNH).

Diagnosis. Encrusting to irregularly massive, firm, rubbery. Surface smooth, glabrous, to finely rugose or verrucose, deep purple in life, light beige or greyish when preserved. Oscules mostly minute, scattered. Cortex variably thick, 0.5–1.5 mm in massive larger specimens, little differentiated except for absence of foreign detritus, which is otherwise scattered to packed through most of the choanosome. Peripheral choanosome sometimes free of detritus, with irregularly meandering canals, paratangential below cortex.

Description. Massive, bluntly ridge-shaped, with asymmetrically triangular cross-section, flat base of attachment. 4 \times 8 cm at base, 3.5 cm in height. Partially enveloped clump of coralline algae and bryozoans on one side. Deep purple in life, firm,

little compressible, rubbery. Now faded to light beige, with light brownish to greyish areas. Surface on sides rugose to verrucose without orientation, otherwise smooth, glabrous. Elevations 2–4 mm wide, depressions similar or narrower. Apical ridge 1–1.5 cm wide and glabrous. Most oscules minute (100–800 μm wide), scattered on ridge, few clustered down one narrow side. Single larger oscule, 2.5 mm wide, on one of elevations below ridge. Cortex 0.5 to 1.5 mm thick, marked by absence of foreign detritus. Matrix of cortex vaguely and finely fibrous, without orientation except along subradial, meandering chones. Excurrent canals subradial in cortex, equal in width to smaller oscules. Subcortical crypts or excurrent canals (connections not seen) meandering in paratangential plane, 0.5 mm wide, with smooth walls. Similar canals meandering deeper in choanosome, surrounded by fibrous matrix, without preferred orientation.

Foreign debris scattered to crowded throughout choanosome, packed in some places, ill-sorted, up to 600 μm in diameter. Choanocyte chambers mostly spherical, 25–36 μm in diameter. Cortex and choanosome contain large quantities of translucent microsymbionts, of one, commonly two to three aggregated globular cells, diameter 7–12 μm . Most colourless in transmitted light, scattered to crowded, those lining canals commonly packed, single, smaller (not exceeding 8 μm), light yellowish. Another form of symbiotic alga, mostly attached to sand grains, irregular, amoeboid to digitate-frondose, light yellowish green.

Remarks. The syntypes of *Chondrosia spurca* and those of *Haliscarca reticulata* relabelled (by Carter?) "*Chondrosia spurca*", in London (BMNH), which I have examined only macroscopically, compare well with the new specimen. The largest one (the lectotype, BMNH 1886.12.15.128, wet, with slide G2756 in the Australian Museum) has deep portions of the peripheral choanosome almost devoid of sand (pl. 3 figs 2–3). The meandering excurrent canals in these areas are up to 3 mm in diameter. In the syntype of *Chondrosia collectrix* Lendenfeld in Sydney (AM G9061, wet), the cortex is thinner than in the Victorian specimens, so that individual foreign inclusions or their clusters in the underlying choanosome are reproduced as conules or fine tubercles (pl. 3 figs 6a–e). The colour is somewhat darker than the present specimen, greyish. The microsymbionts, described by Hallman as "cystocytes", are slightly larger, 15–20 μm in diameter. Possibly a different kind of microsymbionts was described by Hallmann (1914a: 309) as being confined to the smaller canals

in *Reniera collectrix*. The syntype (syntypes?) in Sydney (AM G9014, wet, two halves or two cut specimens, pl. 3 figs 4, 5) is light yellowish brown internally, speckled dark greenish grey.

The West-Indian *Chondrosia collectrix* (as redescribed in Wiedenmayer, 1977a: 189) differs from *C. reticulata* by its darker, almost black colour, softer consistency, and by having a thin, detachable ectosome.

Latrunculiidae Topsent, 1922

Remarks. The sigmatose early ontogenetic stages of discorhabds in *Sigmosceptrella* and the frequent occurrence of polytylote megascleres in the family (the latter stated to be common only in various poecilosclerids) prompted Topsent (1922) to include the Latrunculiidae in the Poecilosclerida. He reiterated this view (1928: 47), granting a common, though distant origin of Spirastrellidae and Latrunculiidae. His view was upheld by Lévi (in Brien et al., 1973: 611). Bergquist (1978: 166) included the family in the Hadromerida, based on earlier biochemical work, followed by Boury-Esnault and van Beveren (1982: 42). Van Soest (1984: 146) left the ordinal assignment of the family open, provisionally following Lévi (1973).

Polytylote monactinal megascleres also occur in *Polymastia* (*P. granulosa*, see Bergquist, 1968: 23; *P. polytylota*, see Pulitzer-Finali, 1983: 490). Early ontogenetic stages of discorhabds in *Sigmosceptrella* are not like typical sigmata and chelae, in having a straight shaft, and spines always appearing simultaneously on distal recurved ends and opposite on the shaft. The homology with poecilosclerid sigmatose microscleres is weakened by the rhabdose earliest stage in discorhabds of *Podospongia loveni* (see Remarks on *Latrunculia* below). Another type of "pseudosigmatose" microsclere, phylogenetically related to spirasters, might be seen in the anthosigma. Similarity by convergence in these "sigmatose" microscleres seems to be analogous to that in dentate chelae and sigmaspires (Dendy, 1921: 119, fig. 31). On the other hand, the presence of true chelae (palmate anisochelae) in *Barbozia primitiva* Dendy (1922: 131f.) might be adduced as a stronger argument for poecilosclerid affinity of the Latrunculiidae (Dendy included the genus in the Spirastrellidae). However, its reticulate skeleton, and Dendy's statement, that its "oxydiscorhabds" are not arranged in a special surface layer like in *Latrunculia*, make it certain that *Barbozia* is an aberrant poecilosclerid (as de Laubenfels, 1936a: 53, and Topsent, 1928: 48, maintained). Its "oxydiscorhabds" (Dendy, 1921, fig. 34C; 1922, pl. 18 fig. 1d) are remarkably simi-

lar to some amphiasters in the spongillid *Dosilia plumosa* (see Dendy, 1921, fig. 26M). Topsent (1928: 48) speaks of "isancres amphiastéroides." Lévi and Lévi (1984: 956) argued convincingly that the microscle-re-complement is unstable in this genus (sigmata or "oxydiscorhabds" may be absent), and that *Barbozia* is a junior synonym of *Phlyctaenopora* Topsent (1904), which they assign to the Coelosphaeridae.

The fossil record has not been sufficiently appraised in this context. Though it does not resolve the issue, it is apt to add a new perspective. The oldest fossil discorhabds are those figured by Rüst (1885, pl. 45 figs 35, 36), now known to be of Lower Cretaceous (Albian) age. That of figure 36 is remarkably similar to the modern type in Carter (1879b, pl. 29 fig. 16). From the same phosphorite nodules from Northern Germany, Rüst figured spirasters (pl. 45 figs 34, 38) and what looks like an anthosigma (pl. 45 fig. 37). Normal sigmata, forceps and chelae (some of otherwise unknown types) are also represented (pl. 45 figs 9–11, 13–15, 17, 20, 21) and so are tylote sigmaspires (pl. 45 figs 12, 16). Normal sigmata, however, are known already from sediments of Triassic age (Mostler, 1976, text-fig. 12).

Some modern discorhabds are exceptionally large for microscle-eres (up to 217 μm long in *Latrunculia multirotalis* Topsent, 1928: 222; up to 377 μm long in *L. biformis*, fide Boury-Esnault and van Beveren, 1982: 44). Even larger are the giant "discasters" in *Sceptrintus* Topsent (1904: 117), a genus now virtually extinct, known only from the type locality in the Azores. These spicules, more aptly described as hypertrophied verticillate sanidasters, have sizes of $150 \times 7 \mu\text{m}$ to $530 \times 40 \mu\text{m}$. They were regarded as megascle-eres by de Laubenfels (1936a: 79), who was undecided whether to include the genus in his "Acarniidae" or in the Agelasidae. Topsent (1904), however, has clearly stated that these spicules are arranged like spirasters in *Spirastrella* and thus should be ranged as microscle-eres. He therefore included *Sceptrintus* in the Spirastrellidae rather than in the Latrunculiidae. *Sceptrintus* must have been very common in the Oligocene around Tasmania (Kennett, Houtz et al., 1975: 333, figs 10–12), and possibly occurs today at great depth in the Gulf of Mexico (*Spongolithis hystrix* Ehrenberg, 1873, pl. 5 fig. 22, isolated spicule in dredged sediment, 2720 m).

Among the fossil microscle-eres from the Oamaru Diatomite of New Zealand figured by Hinde and Holmes (1892, pl. 11 figs 15–45) are many typical discorhabds of *Latrunculia*. The largest (fig. 34) is 206 μm long and resembles those of *L. mul-*

tirotalis Topsent (1928, pl. 7 fig. 19b). Three types (figs 22, 23, 45) have their upper half decorated by microspined or roughened globules, several in one whorl and one apical, similar to one-half of a massive amphiaster of the clionids *Thoosa* and *Alectona* (figs 41, 42 of the same plate). Two types (figs. 32, 44) are close to discorhabds in the modern *Didiscus*. That in figure 32 is uniformly microspined throughout and its discs are marginally inflated. Similar, isolated examples are known from Recent sediment of the Indian Ocean (Carter, 1879b, pl. 29 fig. 20) and from the Upper Jurassic of Poland (Wiśniowski, 1888, pl. 12 fig. 10). Such types particularly in connection with the occasional slight swelling of blunt apices of the axis, as in *Didiscus flavus* van Soest (1984), suggest transitions to, and homology with short criccorhabds with few annuli (Wiedenmayer in Hartman et al., 1980: 72), with the microscle-re type in Carter (1879b, pl. 29 fig. 21), and microspined, nodular amphiasters in *Alectona* and *Thoosa*, which may be asymmetrical (Topsent, 1904, pl. 12 fig. 3b; Annandale, 1915a: 18, text-fig. 3). Those in Topsent (1904) are also suggestive of the type attributed to *Alectona* by Hinde and Holmes (1892, pl. 11 fig. 44). Its shaft is smooth, stronglyloxeote, and bears two symmetrically arranged discs with serrated margins, like in *Didiscus*, but, in addition, a few irregularly distributed tubercles between discs. Other parallels are the microspined sanidaster of *Latrunculia* (*Negombata*) *acanthosunidastera* (Hoshino, 1981: 221, fig. 11b; pl. 4 figs 3, 4), with its blunt clads; and the amphiasters of *Thoosa laevistaster* Annandale (1915a: 22) resembling early stages of, or atrophied discorhabds of *Latrunculia*.

The microscle-re attributed to *Thoosa* by Hinde and Holmes (1892, pl. 12 fig. 3, 30 μm long) combines two structural elements: the massive amphiaster of *Thoosa mollis* Volz (Pulitzer-Finali, 1983: 502, fig. 30 A–C) and the denticulate axial apices like in many discorhabds of *Latrunculia*. Of the microscle-eres ascribed to *Spirastrella* by Hinde and Holmes (1892), those on plate 12, figures 4 and 6, can be regarded as transitional between spirasters and discorhabds, with some spines still in verticils or clustering around the bulbous apices. Analogous transitions were pointed out by Dendy (1921: 123, fig., 39) in *Latrunculia* (*Negombata*) *corticata* Carter.

The tendency, common to some spirasters and irregular discorhabds, to approach amphiasters (compare e.g. *Diplastrella bistellata*, *Suberites wilsoni* in Vosmaer, 1911, pl. 12 figs 4, 9, with *Latrunculia hallmanni*, below, and *Latrunculia* (*Negombata*) *tarentina* Pulitzer-Finali, 1983, fig.

37) has been noted by Topsent (1928: 47). Comparison of the fusiform verticillate sanidasters and 7-whorled discorhabd in Hinde (1910, pl. 1 figs 11–13; Late Eocene) with the sanidasters from the Oligocene of the continental rise off Tasmania (Kennett, Houtz et al., 1975: 333, figs 10–12) suggests a connection between *Sceptrintus* and *Latrunculia*, closer than Topsent imagined.

The spicules ascribed to a new (hypothetical) genus *Ditriaenella* by Hinde and Holmes (1892, pl. 12 figs 34, 35) merit consideration in this context. The one in figure 34 was reproduced by Rauff (1893, p. 155, fig. 11) and named "amphimesodichotriaene." The closest modern equivalents in my opinion are the "amphitriaene" of *Samus* and the normal amphiaser of *Thoosa* (Wiedenmayer, 1977a: 33, figs 29, 30). With regard to the homology of the latter two, I am merely following Topsent's opinion (1928: 28), countering Sollas' influential and misleading view (1888: 57), who qualified the amphiasers of *Samus* as amphitriaenes. Topsent was cautious with regard to the other, smaller microsceres of *Samus*, qualified as sigmaspires by Sollas, a view followed by most subsequent authors (e.g. Pulitzer-Finali, 1983: 481). These microsceres are C- or S-shaped, in one plane or twisted, microspined (not smooth as claimed by Sollas, 1888, and Lendenfeld, 1903). They are thus indeed morphologically similar to the common microsceres of *Spirophorida*. Topsent, rejecting the homology with spirasters, ultimately accepted them as sigmaspires, and admitted a distant relationship with the *Spirophorida* (in which sigmaspires would be the only ancestral trait shared with *Samus*). Considering the presence of spinispirae (microspined spirasters) in *Spirastrella* (*S. spinispirulifera*, see Bergquist, 1968, pl. 11 G) and the similarity with the spirosceres in *Trachycladus* (Bergquist, 1970, pl. 10C/2), convergence of such microsceres cannot be excluded. Reduction of spination and of twisting of spirasters in ancestors of *Samus* might well have occurred.

The fossil spicule of "*Ditriaenella*" connects the amphiasers of *Thoosa* and *Samus* with certain types of discorhabds, in which verticils are more or less regularly lobed, with lobes bifid, trifid, or multifid (the latter in Hinde and Holmes, 1892, pl. 11 fig. 40). Individual verticils of such types commonly comprise four lobes (*Sigmosceptrella quadrilobata*) or three lobes (*S. fibrosa*). Adjoining verticils are often twisted regularly around the axis, so that lobes alternate between whorls when viewed axially. In such view some examples show tendency to dichotomy (Topsent, 1904, pl. 12 fig. 5; 1928, pl. 7 fig. 18b). Oxydiscorhabds are not exclusive

in *Didiscus*, some are known in *Latrunculia* or *Sigmosceptrella* (Hinde and Holmes, 1892, pl. 11, fig. 15; Dendy, 1922, pl. 18 figs 4b, 4b'; Bergquist, 1978, pl. 7b, here with dichotomy at right angles, i.e. in axial planes, a feature also apparent in some fossil examples in Hinde and Holmes (1892), in some extremes resulting in erect apical blades). The two types of "*Ditriaenella*" differ only in the dichotomy being proximal in figure 35, with six equal clads in one whorl (in analogy to the amphiaser of *Thoosa*). Amphiasers in *Samus* (possibly derived from "*Ditriaenella*" amphiasers by reduction of the rhabd ends) are often heteropolar (Carter, 1879b, pl. 29 fig. 3, here microspined; Topsent, 1928: 28; Pulitzer-Finali, 1983, fig. 17, right side), and in this trait they are comparable to some fossil anisodiscorhabds, particularly the curious stubby types in Hinde and Holmes (1892, pl. 11 figs 29–31) with only two whorls and no apical extension of the axis (their similarity to candelabra is here regarded as due to convergence).

Amphiasers of *Samus*, with maximum dimension (diagonally) up to 200 μm , are considerably larger than amphiasers of *Thoosa* (up to 37 μm long in normal types, Wiedenmayer, 1977a, fig. 30; up to 70 μm in the large amphiaser of *Thoosa mollis*; Pulitzer-Finali, 1983: 582). The fossil spicules of "*Ditriaenella*", which could be regarded equally well as amphiasers and as special oxydiscorhabds, are 185 μm long. They, like those of *Samus*, can well be qualified as microsceres, considering the size ranges in discorhabds and sanidasters of *Latrunculia* and *Sceptrintus* cited above.

The special minute microsceres localised in the surface of papillae of *Cliona levispira* and *Dotona pulchella* (Topsent, 1904, pl. 12 figs 1d, 2c) can be regarded as reduced discorhabds, with lengths (6–10 μm) less than one-third of those in the smallest modern latrunculiid discorhabds, and about half as long as the smallest fossil one (Hinde and Holmes, 1892, pl. 11 fig. 27, 18 μm long). *Cliona acustella* Annandale (1915a: 14) contains similar microsceres exclusively.

The analogy with the Chondrillidae in the suppression of megasceres in *Samus* (frequently also in adults of *Alectona* and *Thoosa*; Topsent, 1928: 28) should be pointed out in this context. The question whether the microsceres of "*Ditriaenella*" and *Sceptrintus* are ancestral or derived with respect to discorhabds in Latrunculiidae has to remain open. The much earlier record of the latter (Early Cretaceous) is probably fortuitous. Furthermore, all fossil types are isolated: we therefore do not know what

complements occurred in species of the geological past. However, the balance of these considerations favours a common ancestry of *Latrunculiidae*, *Spirastrellidae* and *Clionidae*, and their differentiation in Early Cretaceous time or earlier.

Latrunculia Bocage

Latrunculia (*Latrunculia*) Bocage

Latrunculia Bocage, 1869: 161. — Ridley and Dendy, 1887: 233. — Dendy, 1921: 121. — Topsent, 1922: 7.

Sceptrella Schmidt, 1870: 58. — Ridley and Dendy, 1887: lxii, 234 (synonymised with *Latrunculia*). — van Soest, 1984: 149 (synonymised with *Latrunculia*).

Negombo Dendy, 1905: 127. — de Laubenfels, 1936a: 132.

Diacarnus Burton, 1934a: 549. — de Laubenfels, 1936a: 133.

Diagnosis. Sanidasters transitional to discorhabds; whorls of spines more than two, but not always distinct (some types transitional to amphiasters). Microscleres may be symmetrical or asymmetrical, with one end pointed (anisodiscorhabd). Amphiclads (reduced discorhabds with spines only in distal whorls) may be present with transitional types (Topsent, 1892: 128; 1928: 220). Basic rhabdosome character of microscleres evident in earliest ontogenetic stages. Megasccleres styles or subtylostyles, often polytylote; not differentiated morphologically in parts of the body. Shape of sponge encrusting to massive, then commonly irregular; not stalked with globular head (as in *Podospongia*).

Remarks. Other genus-group aggregates of the *Latrunculiidae* recorded from southern Australia are *Sigmosceptrella* and *Negombata*. *Sigmosceptrella* Dendy (1921: 122; see also Dendy, 1922: 136) is a good genus and has as type species (subsequent designation by Dendy, 1922: 138) *Spirastrella fibrosa* Dendy (1897), from Port Phillip Heads. A

second species is *Sigmosceptrella quadrilobata* Dendy (1921, 1922), from the Indian Ocean. Fully grown microscleres of this genus are similar to those in *Latrunculia conulosa*, described below, but their early ontogenetic stages are always "sigmatose". The diagnostic value of this trait is lessened by the ontogeny of discorhabds in *Podospongia loveni* du Bocage (as redescribed by Topsent, 1928: 219, pl. 7 fig. 17) being intermediate: earliest stages as slightly wavy rhabds, young stages similar to those in Dendy's drawings, but more irregular.

Negombata de Laubenfels (1936a: 159) has as type species (by original designation) *Latrunculia corticata* Carter (1879b: 298) from the Red Sea. The "genus" is distinct only by having diactinal instead of monactinal megasccleres, and is therefore better treated as a subgenus. *Oxylatrunculia* Hoshino (1981: 221, type species by monotypy *O. acanthosanidastera* Hoshino) is a junior synonym. A third species is *Latrunculia purpurea* Carter (1881a: 380) from Bass Strait, not recorded again. Two more species occur in the Red Sea and a sixth species was described from the Mediterranean as *Latrunculia tarentina* by Pulitzer-Finali (1983: 513, with remarks on Red Sea species). It should be noted that diactinal megasccleres also occur in *Didiscus* and *Podospongia*, but together with monactines and transitional types (styloids).

Latrunculia (*Latrunculia*) *conulosa* Hallmann

Plate 3 figure 7, plate 22 figures 2, 3,
text-figure 22

Latrunculia conulosa Hallmann, 1912: 126, text-fig. 24, pl. 22 fig. 1 (off Devonport, Tasmania).

Material examined. Station KG 6, two specimens (F51952, F51953); station KG 7, one specimen (F51954). Holotype of *Latrunculia conulosa* (AM).

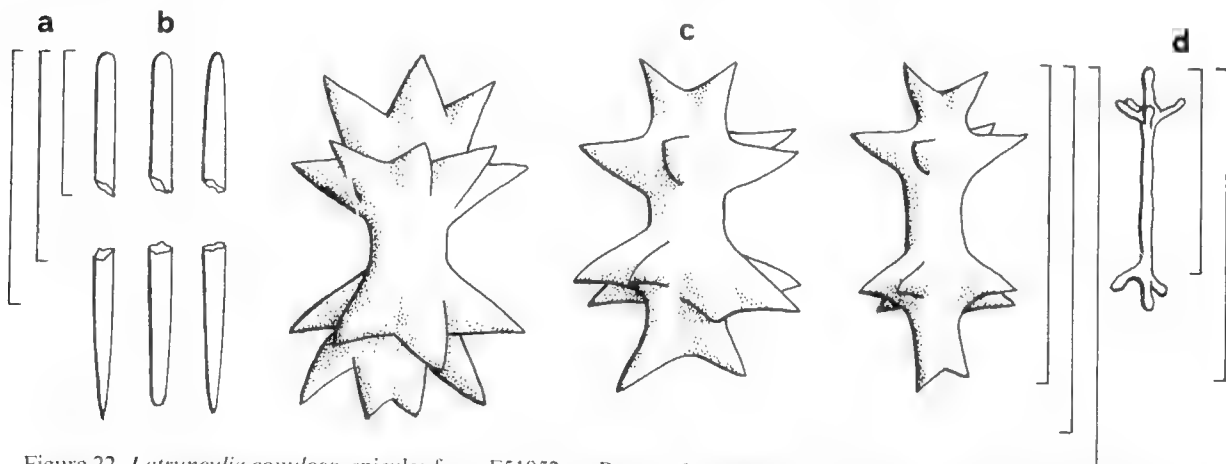


Figure 22. *Latrunculia conulosa*, spicules from F51952. a. Range of megasccleres, $\times 85$. b. Enlarged ends of megasccleres, $\times 329$. c. Large sanidasters with range of lengths on right, $\times 980$. d. Small choanosomal sanidaster, $\times 980$.

Diagnosis. Irregularly lobose, compressible, elastic. Surface mostly conulose, vermilion on top in life, dull orange below. Few clustered oscules. Cortex indistinct, 65–435 μm thick. Sanidasters with large spines in 4 whorls (inner ones more widely spaced), packed to crowded through most of cortex, scattered with smaller ones in choanosome. Styles in compact thick columns, branching in umbels and like candelabra below and within cortex. Few scattered styles. Additional lax skeleton of light collagenous fibres.

Description. Mostly irregularly lobose. In F51952 and F51953 (the latter for two specimens contiguous in situ), lobes are 0.5–3 cm wide, twisted and angular, partly free, partly coalescent, separated by lacunae or narrow grooves. F51954 (pl. 3 fig. 7) more regular, single compressed lobe, 3 \times 5.5 cm wide, expanding from narrow base of attachment (1.5 cm wide) to height 4 cm. Vermilion in life (10 R6–8/12) on top (deeper on conules, lighter in depressions), grading to dull orange below. Some areas become brownish to greenish grey and dull purple when drying. Recessed areas and base pale orange-beige. Moderately firm, compressible, elastic.

In F51952 and F51953, surface irregularly conulose (conules frequently coalescent in short ridges) in exposed areas; faintly verrucose to rugose in other areas, otherwise smooth. In F51954, top and three sides regularly conulose, conules 1–2 mm wide and high, 1–3 mm apart, one wide side weakly verrucose-rugose. Ostia regularly scattered in depressions between conules, barely visible. Few oscules, 0.5–2 mm wide, single or clustered in small subpetaloid groups. Many conules have terete tips of variable length, being protruding ends of collagenous fibres.

Cortex indistinct, 65–435 μm thick, weakly collagenous-fibrous matrix, commonly packed with sanidasters, less frequent inward, leaving some inner portions free. Peripheral choanosome commonly packed with segmented blue-green algae. Two specimens (F51953 and F51954) contain scattered, radially fibrous, fuzzy balls in deeper choanosome, diameters 48–64 μm ; possibly another type of microsymbionts, analogous to that in *Anco-rina suina*. F51952 contains embryos, orange in life.

Main skeleton of compact columns of megascleres with variable diameters and little orientation except below surface. Some columns straight to surface, but most branch repeatedly from peripheral choanosome outwards, forming complex and irregular umbels. In final subdivision within cortex, strands dissolve into parallel tracts of 2–3 spicules abreast, approaching palisades. Some

larger umbels, with bases deep in choanosome, in shape of trees or candelabra, with outermost branches often curved, some recurved like festoons. Central trunks of umbels up to 500 μm thick; away from cortex, some break up again inwards into curved branches, mangrove-like roots, or festoon-like anastomoses between neighbouring trunks. In choanosome between spicular columns, irregularly scattered, disoriented megascleres and sanidasters of various sizes.

Additional lax skeleton of slightly translucent collagenous fibres of irregular cross-section, mostly crooked, twisted, lined by crowded microscleres. Width 0.3–0.5 mm, branching irregularly, with sparse anastomoses, intervals 1–2 mm. Tapering slightly to surface forming axes of conules, protruding occasionally. Many collagenous anastomoses in choanosome much finer, commonly below 50 μm wide, straight to bent, terete.

Spiculation: (1) Styles, occasionally with blunt points, thinner ones with telescoped points; a few modified as strongyles, oxea, and anisostrongyloxea (styloids), 203–291–353 \times 3.5–7.2–9.7 μm . (2) Large sanidasters of cortex and choanosome, total length 37.9–43.7–47.6 μm , width with spines 20.3–24.7–28.8 μm , width of shaft 4.2–5.6–7.4 μm . (3) Small sanidasters of choanosome (developmental stages), 24.4–36.9 \times 8.9–20 \times 1.5–4.1 μm . Typical, most frequent form of large sanidasters between forms illustrated in Hallmann (1912: 127, text-fig. 24b, c). Four distinct, symmetrical whorls of spines: distal ones like crowns, with spines inclined at 45°; inner whorls with spines slightly inclined, their outside in one plane. Shaft between inner whorls distinctly terete. Distance, at spine tips, between inner whorls twice that between each contiguous inner and outer whorl. Spines of inner whorls frequently, those of outer whorls occasionally, bifid. Frequent departures: whorls may be asymmetrical with respect to size, placement and inclination of spines; contiguous whorls may virtually merge; in more massive forms, like in Hallmann's text-figure 24b, centre of shaft no longer terete. Even smallest sanidasters, with spines hardly developed, always have straight shafts.

Remarks. The closest relation is with *Latrunculia* (*Latrunculia*) *hallmanni*, see below.

***Latrunculia* (*Latrunculia*) *hallmanni* sp. nov.**

Plate 3 figures 8–10, plate 22 figures 4, 5,
text-figures 23–29

Holotype: F51955, Station KG 3 (Tasmania, East Cove, Deal Island, Kent Group; W of jetty of settlement, some distance from shore; outcrops and boulders with algal

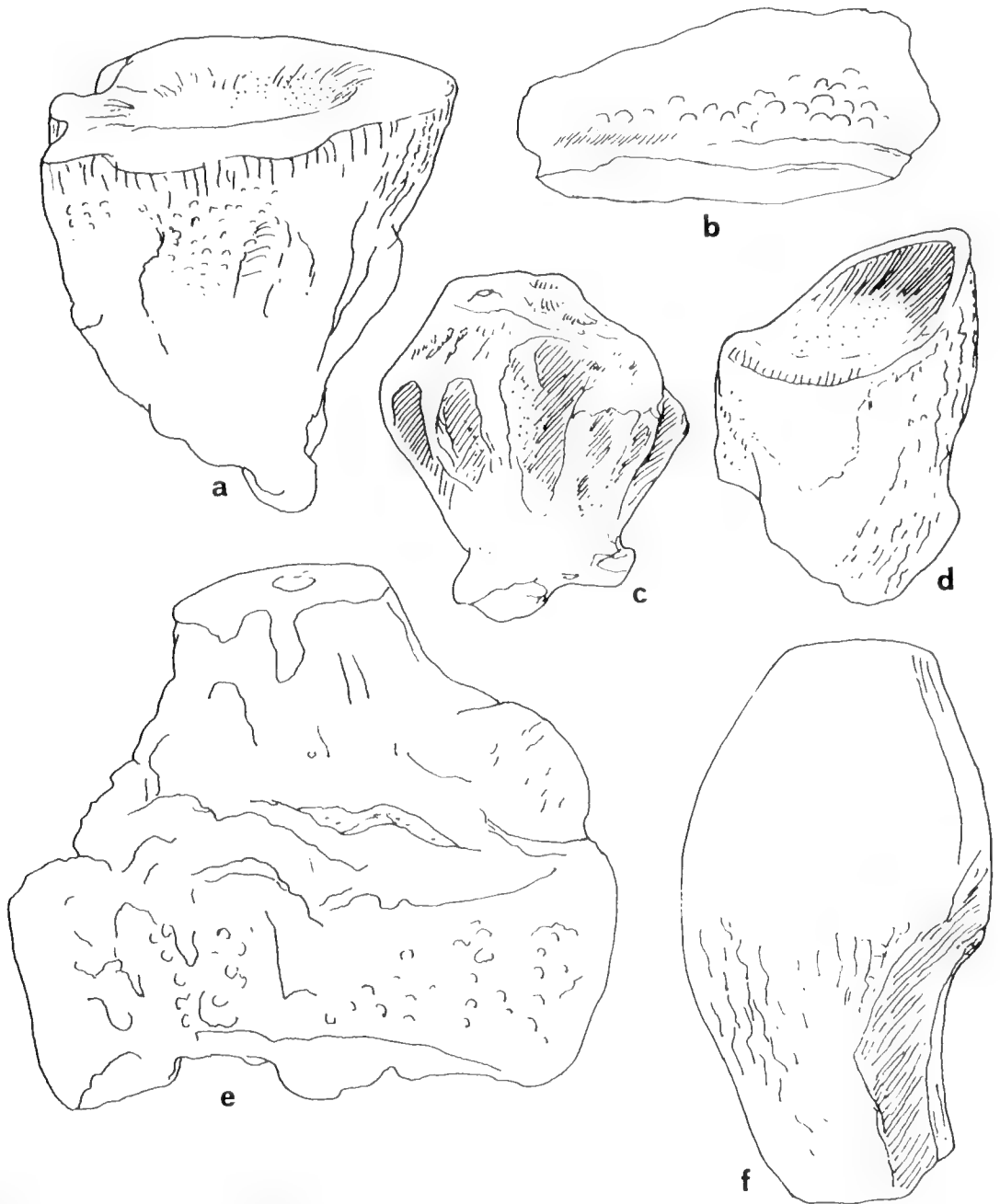


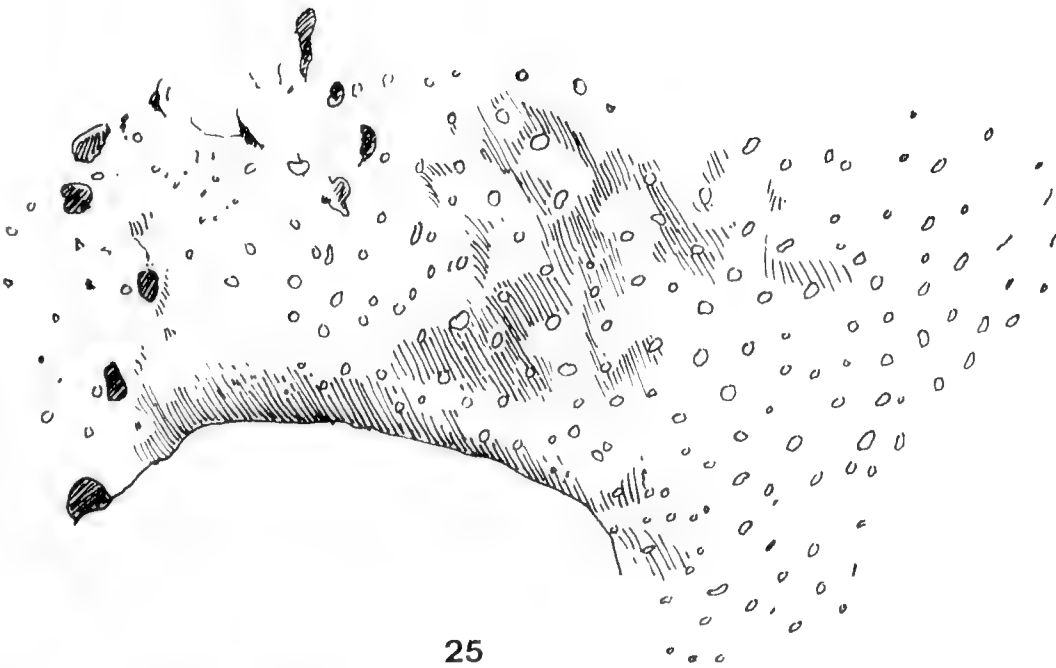
Figure 23. *Latrunculia hallmanni* sp. nov. Variability of shape (not to scale). a. Holotype. b. F51956, with oblique view of base. c. F51957. d. F51958. Note the off-white area on the upper left side, cutting across the bristly lower rim and covering the deeper part of the apical depression (see description of colour). e. F51959, entire specimen. f. F51960, entire specimen.

forest to 10 m). Five paratypes: F51956, station KG 3; F51957, station KG 4 (Tasmania, West Cove, Erith Island, Kent Group; boulders covered with algae, much kelp); F51958, station KG 5 (Garden Cove, N side of Deal Island, Kent Group; boulders with algae); F51959 and F51960 (schizoparatypes), station KG 8 (East Cove, Deal Island, Kent Group, halfway between jetty and North Point; rocky level bottom).

Diagnosis. Shape variable, mostly irregularly massive, large. Rubbery, fairly compressible. Surface variably verrucose to rugose, brain-like, or almost smooth. Irregular depressions frequent on top and sides. Colour variable, dull red-purple, red-orange-brown, and off-white, often in different patches on same sponge. Oscules scattered or clustered,



24



25

Figures 24, 25. *Latrunculia hallmanni* sp. nov. Details of surface, $\times 4.8$. Figure 24. F51957, depression with stellate clusters of ostia. Figure 25. Holotype, marginal area of apical depression with two types of oscules. The area is bordered above by the tabulate margin, below by a narrow fold.

tending to segregation by 2 sizes. Cortex tough, collagenous, 0.6–2 mm thick, detachable, tends to shrink and crack after preservation. Sanidasters massive, more irregular than in *L. (L.) conulosa*, with outer and next-inner whorls often merging (approaching amphiasters), mostly confined to thin

outer crust in cortex, but numerous in choanosome. Columns of styles thinner, branching mostly within cortex, with branches more closely spaced than in previous species. Scattered styles and sanidasters in choanosome more numerous, reticulation of collagenous fibres tighter than in *L. (L.) conulosa*.

Description. Shape and size variable (text-fig. 23). More massive and larger than *Latrunculia conulosa*. Three types of macroscopic surface conformation: (1) finely and regularly verrucose to rugose, more or less like in *Latrunculia conulosa*; (2) convoluted, with meandering and branching furrows, i.e. cerebroid, commonly also coarsely verrucose; (3) almost smooth or faintly and irregularly verrucose-rugose. The three types may be associated with transitional zones and overlaps. Some specimens have a truncate top, with one or more concave depressions bearing oscules. Concave depressions may occur on sides.

Holotype (pl. 3 fig. 8), growing on a steep rock face, a wide inverted conc, 8 cm high, 9.5×11.5 cm wide at top. Sides convolute, with deep furrows. Truncate top bears a central concavity, 1.5 cm deep, 4–6 cm wide, folded lengthwise, containing oscules of two sizes. Marginal area of top flat, mostly smooth. Upper portion of free sides, to a level 3 cm below top, shows surface type 1 superimposed on type 2, which prevails deeper down. Verrucose-rugose pattern, with furrows spaced 3 mm, perpendicular to rim of top.

Paratype F51956 (pl. 3 fig. 9) depressed-pear-shaped, $6 \times 9 \times 5$ cm; surface as type 2 on one broad side, type 3 on the other, type 1 on narrow sides near base.

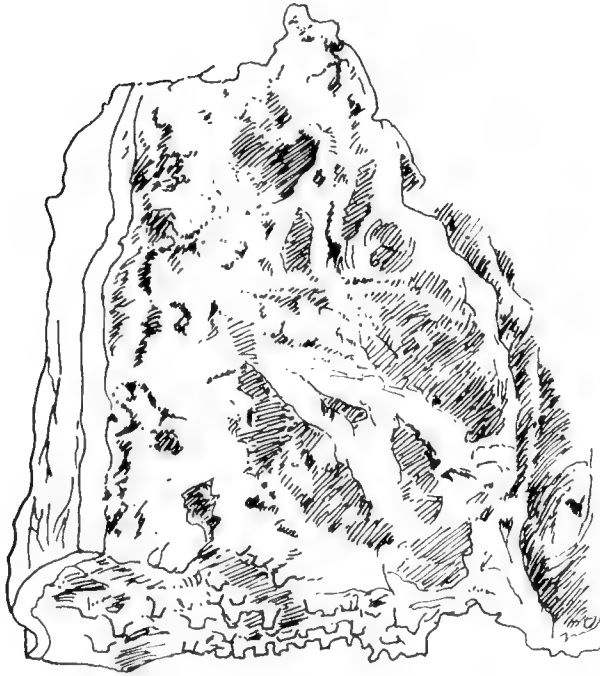
Paratype F51957 (pl. 3 fig. 10) irregularly bulbous, expanding to inverted pear-shape from constricted base, which is 3×4 cm wide. Height 7.5 cm, upper width 5 to 6 cm. Sides furrowed by concave depressions, elongate upwards, with sharp rims and regular to sinuous outlines. Top has two shallow depressions containing one conspicuous oscule (3 and 4 mm) each.

Paratype F51958 like a stump truncated obliquely, with top regularly hollow. Width 4 cm, height 4–6 cm. One side has surface mostly of type 2, other side and concave depression on top with surface type 1. Rim of apical depression and its inside distinctly bristly. Five conspicuous oscules on sides, one at bottom of pit on top.

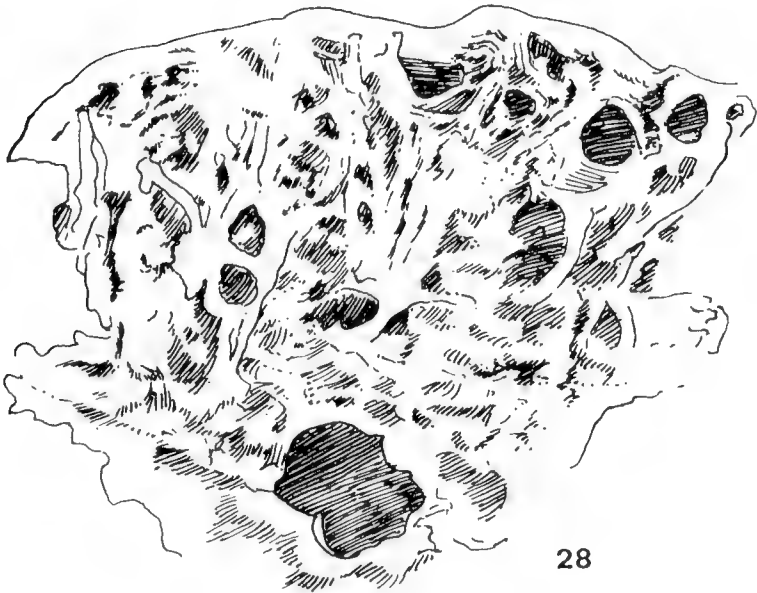
F51959 and F51960 cut from large specimens. The former originally cake-shaped below, with undulating, horizontal ledges at mid-height, with volcano-shaped, slightly constricted upper portion, flattish smooth top containing central pit. Greatest



Figure 26. *Latrunculia hallmanni* sp. nov. F51956, sagittal section in reflected light, $\times 8.2$. The cortex is partly hirsute on top and is joined by a thicker and a thinner collagenous fibre. A conical cribriporal group is visible on the side.



27



28

Figures 27, 28. *Latrunculia hallmanni* sp. nov. F51957, sections in reflected light. Figure 27. Sagittal section, $\times 4.1$, with cortex on left. The oblique view of the section parallel to the base, below, shows longitudinal collagenous fibres brought out by shrinkage of the interstitial choanosome. Figure 28. Section parallel to base, from below, with cortex above, $\times 5.5$.

width 22 cm, height 20 cm. F51960 like a thick angular club or menhir (megalith), 20 cm high, 6 cm wide at constricted base and top, 12 cm in bulging middle.

Colour never uniform, basically three hues, sharply set off, or intergrading and mottled: (1) dull red-purple, chiefly on prominent portions of sides with surface type 1; (2) red-orange-brown, darker in depressions, lighter on portions with surface types 2 and 3; (3) off-white with tinges of hues 1 and 2, mostly confined to narrow area around base, but in F51958 in irregular patch on portions of one side and of apical depression (text-fig. 23d). Hue 1: 2.5 R5-6/6 (F51958), 5 R5/4 (F51959). Hue 2: 10 R6-7/6-8 (F51959), 10 R- 2.5 YR6-7/6 (F51955). Hue 3: N 9- 10 (YR, 1) (F51955). Fresh choanosome beige to orange-brown, darker for the canal linings: 5 YR8/8 and 5 YR9/4, respectively, for F51959.

Rubbery, fairly compressible. Cortex on top tends to shrink and tear in alcohol (holotype). Little consistence in size and distribution of oscules with regard to sides, top, depressions and surface types. They may be scattered or clustered. Oscules in holotype virtually confined to apical depression, of two categories: (1) regularly spaced, numerous, small; (2) irregularly scattered, larger, often elongate and twisted, 0.5-1 mm wide (text-fig. 25). Larger oscules round, up to 4 mm wide, commonly single, some paired, confined to top (F51957), or more numerous on sides (F51958). Larger oscules with slightly raised lips on top of F51960.

Ostia inconspicuous, in very fine grooves meandering, anastomosing and branching, mostly in

depressions. Some grooves with ostia form isolated stellate groups, particularly in lateral depressions of F51957 (text-fig. 24).

Cortex tough, collagenous, easily detachable, 0.6 to 2 mm thick. Surface commonly microhispid with protruding megascleres. Collagenous matrix distinctly fibrous, mostly without orientation. Single terete chones disposed radially or obliquely, rarely paratangentially, lined with microscleres. One conical cribriporal group seen in section (text-fig. 26). Extensive narrow, slitlike subcortical crypts. Incurrent canals dendritic in choanosome. Excurrent canals straight, mostly radial, up to 4 mm wide, surrounded by thinner extensions of cortical matrix. Lumina terete, except irregular constrictions. Other excurrent canals compressed, twisted, with curving folds on insides, like in human ear (text-fig. 27). Their collagenous walls frequently separated from surrounding chaonosome by thin voids, possibly accentuated by shrinkage in alcohol.

Skeletal structure much like in *Latrunculia* (L.) *conulosa*, but collagenous fibres better developed, more closely spaced (text-figs 27, 28). No secondary reticulation of finer fibres in choanosome. Tapering main fibres at surface of type 1 form axis of conules and protrude. Around rim of F51958 bristles are protruding fibres.

Differences in structure of spicular skeleton most pronounced in cortex and periphery. Microscleres crowded in outer quarter to half of cortex in *Latrunculia* (L.) *hallmanni*, scarce further in, unlike in *L.* (L.) *conulosa*, where microscleres are packed at surface and crowded below, throughout cortex. Repeated branching of spicular columns

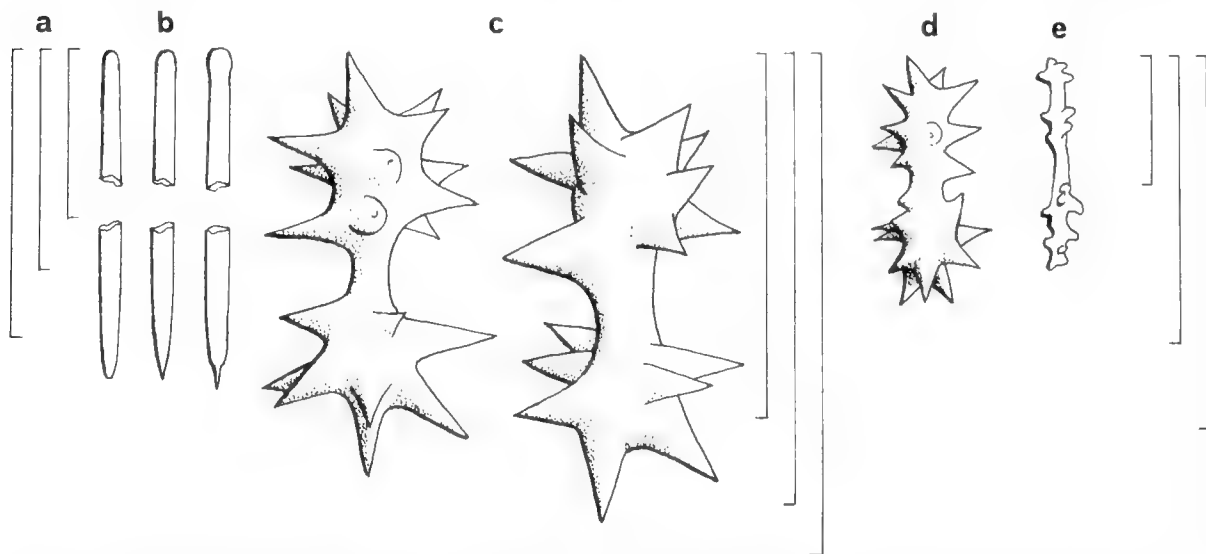


Figure 29. *Latrunculia hallmanni* sp. nov., spicules from F51958. a. Range of styles, $\times 85$. b. Enlarged ends of styles, $\times 329$. c. Massive sanidaster, $\times 980$. d, e. Small and intermediate sanidaster, $\times 980$.

begins well below cortex in *L. (L.) conulosa*, with branches in inner cortex still thick and irregularly spaced. In *L. (L.) hallmanni*, profuse branching begins just below cortex, with cortical branches thin and regularly spaced, and final, palisade-like subdivision within zone of crowded microscleres. Interstitially scattered megascleres and larger microscleres in choanosome more numerous in *L. (L.) hallmanni*.

Spiculation (holotype): (1) Styles to faint substyles, straight to slightly bent, terete or thickest nearer to point, points short, conical to mucronate or blunt, $237\text{--}311\text{--}404 \times 3.5\text{--}6.3\text{--}9.1 \mu\text{m}$. (2) Massive sanidasters transitional to amphiasters, in cortex and in cortical matrix lining excurrent canals, collagenous fibres and columns of megascleres in choanosome, total length $44.4\text{--}55.1\text{--}60.6 \mu\text{m}$; total width $28.8\text{--}34.4\text{--}42.6 \mu\text{m}$; width of shaft $7.1\text{--}9.8\text{--}13.2 \mu\text{m}$. (3) Small to medium sanidasters, in choanosome and inner cortex, total length $15.5\text{--}34.7\text{--}44.7 \mu\text{m}$; total width $10.1\text{--}17.8\text{--}25.6 \mu\text{m}$; width of shaft $2.3\text{--}4.4\text{--}6.4 \mu\text{m}$.

Etymology. The name honours E.F. Hallmann, who, during his activity at the Australian Museum in Sydney, did much to promote the knowledge of the Australian sponge fauna, particularly by revising Lendenfeld's types.

Remarks. Besides the differences from *Latrunculia (L.) conulosa* in skeletal structure, mentioned above, *Latrunculia (L.) hallmanni* is distinct in colour, in a more collagenous, detachable cortex, and in having larger, more massive sanidasters in the cortex. While there is some overlap in size and shape of smaller sanidasters between the two species, those in *L. (L.) hallmanni* frequently have their shaft spined or tuberculate, and spines at both ends rarely in distinct whorls. The large sanidasters in *L. (L.) hallmanni* commonly look like a pair of oxypherasters joined by a short, stocky shaft.

Judging from its description, *Axos spinipoculum* Carter (1879b: 286, pl. 25 figs 1–9; type species of *Diacarnus*), from Port Jackson, Sydney, is also a *Latrunculia (Latrunculia)*. Its shape is that of a waisted tall cup, and its surface is extraordinarily convoluted and lacinate. It agrees with both species above in having cortex, canal linings and fibrous skeleton of similar collagenous, fibrillate material. Its sanidasters are distinctive: long and slender ($68 \times 3 \mu\text{m}$), symmetrical, with four whorls of small spines (2 median, 2 distal) about equally spaced along the terete shaft. The one figured resembles the young stage in *L. (L.) biannulata* Topsent, 1892 (see Topsent, 1904, pl. 12 fig. 6b' right), but the whorls are irregular, with some

spines, distally often all, described as being recurved.

There are several similarities, of both species of *Latrunculia* here described, with the descriptions of *Sigmosceptrella fibrosa* (Dendy, 1897: 254; Dendy and Frederick, 1924: 507). However, the protorhabds (early stages of sanidasters, beginning as tylotes) in all preparations examined are always straight, and no single "sigmatose" one was found. Though bifid spines are common in the inner whorls of sanidasters of *Latrunculia (L.) conulosa* (rare in *L. (L.) hallmanni*), I could not detect the regularly "trilobate" arrangement described for *Sigmosceptrella fibrosa*, nor the quadrilobate one of *S. quadrilobata*.

Order Axinellida Lévi, 1955

Axinellidae Ridley and Dendy, 1887

Pseudaxinella Schmidt

Pseudaxinella Schmidt, 1875: 120. — Thiele, 1903b: 378 (type species redescribed). — Wiedenmayer, 1977a: 155 (revised diagnosis).

Diagnosis. Mostly massive, unbranched Axinellidae without axial or mesial condensation of skeleton. Spiculation as in *Axinella*. More or less parallel and plumose, anastomosing ascending columns of spicules may be so crowded that the structure appears confused.

Pseudaxinella decipiens sp. nov.

Plate 3 figure 11, plate 22 figure 6,
text-figure 30

Holotype: F51961, Bass Strait, 17 km S of Warrnambool ($38^{\circ}32.0'S$, $142^{\circ}28.6'E$); depth 52 m, coarse sand and shells (stn BSS 187).

Diagnosis. Small, ridged-crescent-shaped, very firm; in life, buff with greenish grey areas. Surface smooth to verrucose, microhispid. Oscules scattered, minute. Spicular skeleton of intergrading

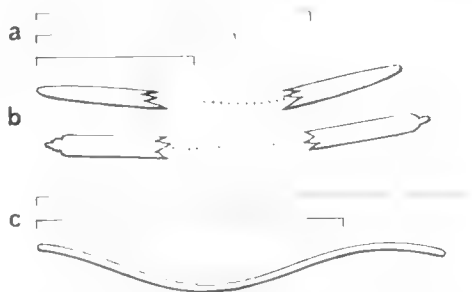


Figure 30. *Pseudaxinella decipiens* sp. nov., spicules. a. Range of oxea and styles, $\times 67$. b. Enlarged ends of oxea, $\times 260$. c. Flexuous strongyles, with range, $\times 67$.

oxea and styles, mostly confused, with rare long and flexuous strongyles.

Description. Asymmetrical wedge, bound by three crescent-shaped areas separated by sharp edges. Base of attachment and narrower side flat, but with angular folds and depressions. Other side, separated by sharp curved ridge along top, regularly convex, smoother than opposite side. 3×4 cm wide at base, 2 cm high. In life, buff with greenish grey areas. Very firm, little compressible.

Surface on larger, convex side almost glabrous along base, verrucose in one corner. Areas near other corner and apical edge rough, microhispid, like opposite side. Oscules minute, indistinct, elongate, vermiculate. Sand grains scattered on surface. Choanosome dense, with few small meandering excurrent canals.

Skeletal structure mostly confused, except tracts and bundles of 2–4 spicules intersecting at variable angles. Much light-yellow spongin, with small round meshes, 20–125 μm wide, in interstices of spicular meshwork, occasionally traversed by single spicules. Spicular meshwork of intergrading styles and oxea with some longer flexuous strongyles interlaced.

Spiculation: (1) Oxea and styles, both infrequent, connected by numerous strongyloxea and anisostongyles (one end mucronate); points most frequently blunt or telescoped; all commonly curved or bent; $278\text{--}350\text{--}483 \times 4.1\text{--}7.8\text{--}11.2 \mu\text{m}$. (2) Flexuous strongyles, about 1–2% of all spicules, $542\text{--}770 \times 4.7\text{--}9.1 \mu\text{m}$.

Remarks. Comparison should be made with *Axinella aurantiaca* Lendenfeld (1888: 235, pl. 5 fig. 1; redescribed by Hallmann 1914c: 424, text-fig. 19, pl. 21 fig. 1). The spiculation is very similar, but otherwise only the structure of the axial skeleton in *A. aurantiaca* is comparable to that in *Pseudaxinella decipiens*.

The external shape and the differentiation of the peripheral skeleton in the branches of Lendenfeld's species are characteristic of *Axinella* as generally accepted. Burton (1928: 129) transferred *A. aurantiaca* to *Bubaris* on account of the flexuous strongyles. This cannot be upheld if the definitions of *Bubaris* by Dendy (1922: 62) and Hechtel (1969: 25) are accepted. There is a better agreement of *Pseudaxinella decipiens* with *Axinella* (correctly *Pseudaxinella convexa* Hoshino (1981: 207, text-fig. 1; pl. 1 fig. 1)). The main spicules in the Japanese species are chiefly oxea, about twice the size of those in *P. decipiens*, and the flexuous diacts are oxeote, also larger than in our species.

The presence of long flexuous diacts in *Pseudaxinella* confirms the doubt as to the diagnostic value

of such spicules in the Axinellida, as expressed by Vacelet (1969: 177) and Pansini (1983: 79). Vacelet's discussion also included the definition and distinction, from *Axinella*, of *Phakellia*. *Phakellia* was redefined and discussed, chiefly with regard to Indo-Pacific species, by Bergquist (1970: 17, 18). A further question that needs to be introduced in this context, pending a comprehensive revision of the Axinellida, is the position and suitable diagnosis of *Pseudaxinella* and "*Teichaxinella*" (recte *Axinosis*) for which I have given revised diagnoses (Wiedenmayer, 1977a: 154, 155). These definitions are admittedly based on species of the central Atlantic, and are probably too restrictive. If allowance is made for accepting *decipiens* and *convexa* in *Pseudaxinella*, with their confused skeleton; and if the diagnosis of "*Teichaxinella*" is slightly widened, so that *Phakettia* (see Koltun, 1959: 200) and *Axinosis* Hallmann (1914b: 349) become synonyms, skeletal structure would no longer be viable as diagnostic criterion in this group. Nor would relative proportions of oxea and styles, including the extremes of their mutual suppression (which would sink *Homaxinella*). Lack of a special axial (or mesial) skeleton, and external shape (thinly flabellate to caliculate in *Axinosis*, massive to thickly flabellate in *Pseudaxinella*, surface smooth to aculeate or hispid in both) could alone be used.

Distinctions could be arbitrary with some thickly flabellate species such as *Phakellia* (recte *Pseudaxinella*?) *tumida* Dendy (1897: 236).

Reniochalina Lendenfeld

Reniochalina Lendenfeld, 1888: 82. — Hallmann, 1914b: 346f (discussion, revision: genus dubium).

Axiamon Hallmann, 1914c: 440 (objective synonym). — de Laubenfels, 1936a: 130.

Diagnosis. Mostly frondose or anastomosing-ramose, occasionally lobose Axinellidae without axial or mesial condensation of skeleton. Spiculation as in *Axinella*. Surface thrown into fine anastomosing grooves and ridges, the latter tuberculate or (commonly) lacinulate.

Remarks. Lendenfeld (1888: 82f.) described two species in *Reniochalina*, *R. stalagmitis*, the type species (subsequent designation by Hallmann, 1914b: 347), and *R. lamella*. They are here synonymised. In contrast to Whitelegge (1902b: 277, 283), who accepted the types, Hallmann (1914b: 346f.) rejected the types of Lendenfeld's species in the Australian Museum (2 syntypes of *R. stalagmitis*, AM G9004 and B5478, wet, and one of the syntypes of *R. lamella* known to him) as such, because of inconsistency with Lendenfeld's descrip-

tions. Admitting only the latter, he pronounced *R. stalagmitis* unrecognisable and *R. lamella* as possibly belonging to *Axinisia* Hallmann. The three rejected types were redescribed, and those in the Australian Museum illustrated (one for each species) by Hallmann (1914c: 441, text-fig. 23, pl. 18 figs 2, 3, the latter quoted in reverse in text and captions) under the name *Axiamon folium* gen. et sp. nov., with no other types. The three type specimens in question, plus the second syntype of *R. lamella* (BMNH: 1925.12.1.18, unknown to Whitelegge and Hallmann), all of which I re-examined (see pl. 4 figs 2–3) are sufficiently documented as such by respective museum-register entries and autograph labels. Despite the inconsistencies in Lendenfeld's descriptions, it is clear that Lendenfeld based *Reniochalina* on these specimens. Hallmann's action is indefensible (ICZN Article 18a), and both *Axiamon* and *A. folium* are objective synonyms.

Reniochalina was hitherto only known from the specimens discussed above. It is closest to *Axinisia* in skeletal structure, spiculation and general shape, but the lacinate surface pattern is distinctive. In this respect, it is similar to *Ptilocaulis* (see Wiedenmayer, 1977a: 152). Morphological variability of specimens assigned to *Reniochalina* by Lendenfeld (including two unnamed species of Hallmann, 1914b: 443, probably synonymous with

R. stalagmitis, here figured in pl. 4 figs 4–5) overlaps with that of *Ptilocaulis*. Pending a more thorough re-examination of Lendenfeld's specimens in London, *Reniochalina* is here retained as a valid genus, having oxea in addition to styles, and lacking axial and mesial condensation of the skeleton. But the variability in spiculation noted by Hallmann, and the rather confused skeletal structure in the following new species raise the same suspicion expressed above, concerning *Axinisia* and *Pseudaxinella*, that presence or absence of certain types of megascleres and of axial/mesial condensation may be synapomorphies with little systematic importance.

***Reniochalina sectilis* sp. nov.**

Plate 4 figure 1, plate 23 figure 1,
text-figure 31

Holotype: F51962, Bass Strait, 17 km S of Warrnambool (38°32.0'S, 142°28.6'E, depth 52 m, coarse sand and shells), stn BSS 187.

Diagnosis. Small, massive-lobose, rubbery, dull orange in life. Surface with regular grooves and tabulate ridges branching and anastomosing. Oscules inconspicuous, in grooves. Spicular skeleton variably dense, confused to subisodictyal, felted or densely umbellar in ectosome. Spongin encasing bundles of styles only.

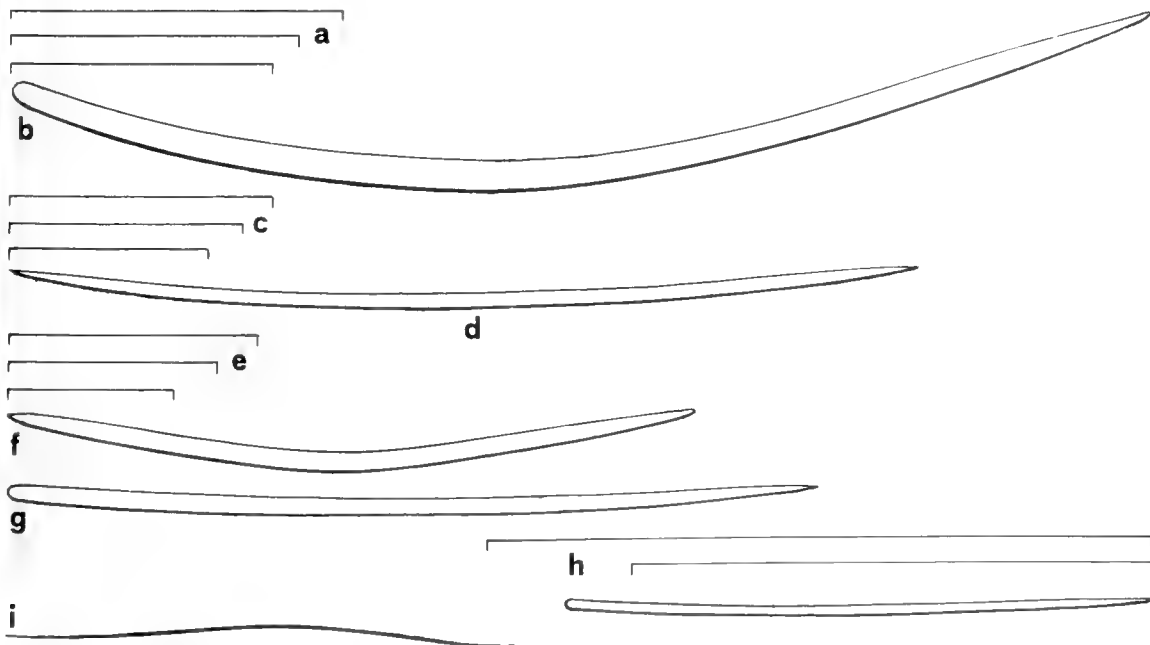


Figure 31. *Reniochalina sectilis* sp. nov., spicules. a. Range of main styles, $\times 84$. b. Main style, $\times 328$. c. Range of main oxea, $\times 84$. d. Main oxeon, $\times 328$. e. Range of dermal oxea and styles, $\times 84$. f, g. Dermal oxeon and style, $\times 328$. h. Choanosomal styles (with example of mean length), 87. i. Choanosomal filiform diactines, $\times 328$.

Description. Massive, with two basally coalescent diverging lobes: one little individualised, 2 cm long, free end 5 mm high, other one tapering, twisted, 3.5 cm long (free end 2.5 cm long). Width at base 2.5×3 cm. In life dull orange, now, in alcohol, dark orange-brown (5 YR3-4/2-4). Rubbery, moderately compressible. Surface with narrow ridges and grooves, both 1-2 mm wide, straight to crooked. Ridges tabulate, microhispid with protruding spicules; often merging, branching and anastomosing, as for grooves. Grooves semiterete, smooth except frequent fine transverse striation of collagenous nervures. Few small oxules in grooves. Collagenous dermis of grooves occasionally wanting, especially near base, with choanosome unprotected.

Main skeleton in two elements: (1) Irregular subisodictyal reticulation of bundles of styles and styloids, frequently encased in clear spongin. Some spongin fibres up to $185 \mu\text{m}$ thick. (2) Oxea scattered interstitially. Main skeleton generally confused, lax to locally dense.

Ectosome contains felt of oxea, styles and styloids, little different from those of choanosome, but smaller, thinner, often in overlapping umbels.

Spiculation: (1) Styles and styloids of main skeleton (anisostrongyles, anisostrongyloxea), mostly curved to strongly bent, $388-423-487 \times 7.7-12.2-16.5 \mu\text{m}$. (2) Oxea of main skeleton, straight or, more often, gently curved, $298-345-390 \times 4.7-5.8-7.6 \mu\text{m}$. (3) Dermal oxea, styles and styloids, $250-306-367 \times 4.7-5.8-7.5 \mu\text{m}$. (4) Long styles, rare, in choanosome, $762-974 \times 9.1-11.5 \mu\text{m}$. (5) Straight to irregularly flexuous filiform diactines, rare in choanosome, around $190 \times 1.2 \mu\text{m}$.

Remarks. The spiculation is similar to that of *Reniochalina stalagmitis*, as described by Hallmann (1914b: 442, text-fig. 23). *R. stalagmitis* has special,

but rare, ectosomal spicules; there is imperfect segregation, in measurements, of oxea and styles/styloids (styles being rare); interstitially scattered spicules are lacking. The strong development of spicular umbels in the ectosome of *R. sectilis* is somewhat reminiscent of the Raspailiidae. But non-specialisation and absence of echinators in the main skeleton do not favour such an affinity. The lack of surface-lacinules in *R. sectilis* is a further distinction. In the smaller specimen figured by Hallmann, and in some areas of the larger specimen on the same plate, the lacinules are short and distinctly aligned on ridges. This is particularly evident in the second syntype (fragment) of *Reniochalina lamella* (pl. 4 fig. 2a), where lacinules are scarce.

Rhaphoxya Hallmann

Rhaphoxya Hallmann, 1917a: 641 (definition, discussion), 674 (systematic position).—Bergquist, 1970: 18 (discussion).

[*Acanthellina*] Carter, 1885e: 365 (nomen oblitum).—Bergquist, 1970: 18 (in discussion, = *Acanthella* sensu Carter, nec Schmidt).

Diagnosis. Massive to thickly flabellate, fleshy Axinellidae with lax, not condensed spicular skeleton. Surface strongly conulose, rugose to lacinulate. Choanosome cavernous. Spiculation as in *Axinella*, but frequently with filiform spicules. Dermis may be reinforced by tangential megascleres.

Rhaphoxya cactiformis (Carter)

Plate 4 figures 6-12, plate 5 figures 1-3, plate 23 figure 2, text-figure 32

Acanthella cactiformis Carter, 1885a: 114, pl. 4 fig. 6 (part? Port Phillip Heads).—Carter, 1885e: 364 (old record).

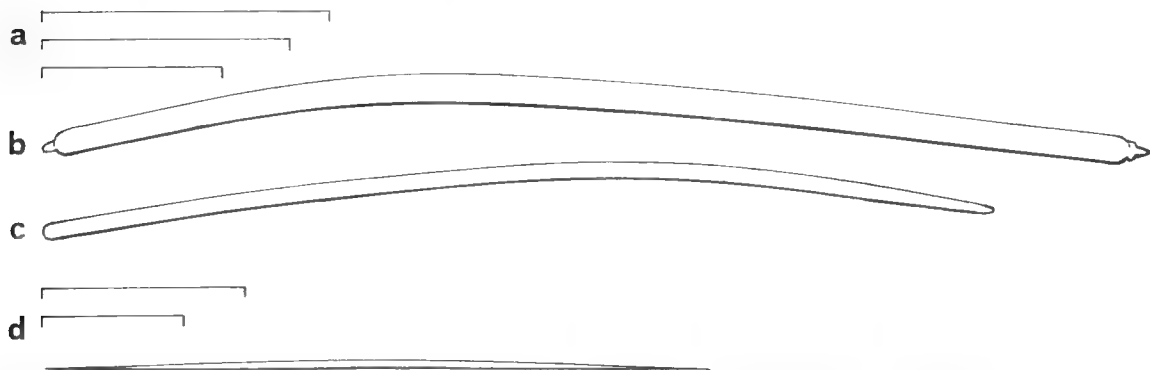


Figure 32. *Rhaphoxya cactiformis*, spicules. a. Range of styles and styloids, $\times 84$. b. Enlarged styloids, $\times 328$. c. Range ($\times 84$) and example ($\times 328$) of fine oxea.

Rhaphoxya cactiformis. — Burton, 1934a: 565 (transfer only). — Bergquist, 1970: 18, pl. 4A (discussion; lectotype designated (as "holotype"), re-examined and figured).

Acanthella hirciniopsis Carter, 1885e: 364 (Port Phillip Heads). — Burton, 1938: 20 (Tasmania, new record only).

Acanthellina parviconulata Carter, 1885e: 365 (Port Phillip Heads).

Acanthellina rugolineata Carter, 1885e: 365 (part? Port Phillip Heads).

Acanthella stipitata. — Dendy, 1897: 237 (part: synonyms of Carter, 1885, only, with type data; not *Acanthella stipitata* Carter, 1881a (unrecognisable, holotype destroyed) nor Dendy's specimens (= *Phakellia dendyi* fide Bergquist, 1970: 18).

Material examined. Station BSS 187, two specimens (F51963). Type specimens of *Acanthella cactiformis*, *Acanthella hirciniopsis*, *Acanthellina parviconulata*, and *Acanthellina rugolineata* (BMNH).

Diagnosis. Flabellate, commonly pedunculate. Rubbery; little compressible in peduncle, softer, elastic in frond. Buff to flesh-coloured in life. Both faces of frond with radial folds sparsely branching and anastomosing, bearing complex conules and lacinules, separated by equally wide, mostly smooth grooves. Oscules marginal. Dermis glabrous, diaphanous in grooves, roofing regularly punctiform vestibules. Cartilagenous collagen of peduncle continues as mesial ribs in frilly folds, with lateral branchlets in axis of lacinules. Spicular skeleton in frond lax, confused to vaguely columnar.

Description. Intermediate, in size and shape, between complete syntype of *Acanthella hirciniopsis* (pl. 4 fig. 12), and lectotype of *A. cactiformis* figured by Bergquist. Like in former, peduncle distinct, almost smooth, slightly compressed; conules low, mostly aligned radially; dermis diaphanous over numerous, scattered small subdermal cavities. As in lectotype, fan wide, thin, symmetrical, without marginal oscules. Buff-to flesh-coloured in life, paler in alcohol. Firmly rubbery to tough, little compressible, in peduncle and mesial branches; softly rubbery in conules and ridges. Soft, limp interstitially and in dermis. Dermis with fine reticulum of collagenous nervures, radial around conules, transverse in furrows. Ostia regularly scattered between nervures. Few sand grains. Hard peduncle with dense collagenous matrix surrounding spicules, extending into mesial region of lamella, repeatedly branching to margin. Branches anastomosed. All collagenous elements end in perpendicular branchlets within conules and ridges at surface.

Choanosome cavernous; wide, annulate excurrent canals commonly parallel to plane of lamella below depressions of surface, perpendicular in prominent parts of larger specimens. Subdermal apices of regularly spaced perpendicular incurrent canals 150–700 μm wide, 0.7–1.5 mm apart, conspicuous in smaller specimens with wide radial sulci. Mesial portion of frond contains lax, random arrangement of spicules, some grouped in wispy columns (pl. 23 fig. 2). Interstitial and peripheral choanosome collagenous, densely granular, light brown in transmitted light, mostly devoid of spicules except plumose to chaotic zones, 350–1000 μm wide, oblique to surface, ending in conules, some piercing surface. Dermis around 175 μm thick, fibrillous, clearer than choanosome, with scarce foreign spicules and debris; occasionally pierced by groups of spicules.

Spiculation: (1) Styles and styloids (strongyles, strongyloxea, anisoxea, the latter mostly with telescoped ends; some styles with a mucronate, curved or bent, occasionally flexuous, rarely straight apex); 248–343–397 \times 1.9–5.6–9.7 μm . (2) Fine fusiform oxea and filiform diactines, often broken; possibly not a distinct category, 192–281 \times 1.3–3.1 μm .

Remarks. With respect to Carter's four synonyms and their type specimens, most of which are illustrated here, the following variables in external shape can be outlined: more or less symmetrical fan-shape with rounded outline can be maintained with growth to a medium size. Particularly in larger specimens, the lamella may be asymmetrical, lacunose, with an irregularly sinuous margin. A peduncle is not always developed: in some specimens, the base of attachment occupies the whole width of the lamella. The peduncle may also be covered by conules, though small ones. In smaller specimens the conules may be scattered at random, or, more often, are connected by ridges arranged radially. These may be more widely spaced and concave, or equal to the ridges in width, both showing v-shaped cross-section. Oscules in smaller specimens are mostly irregularly scattered, and seem to favour positions on the lower part of the lamella, near the margin, along parts or all of the margin, but rarely with consistence. They are up to 5 mm wide, often elongate or sinuous.

In larger specimens, the lateral ridges grow outward, thickening and coalescent in irregular fashion, with conules proliferating in various directions. The result is a disorderly and complex arrangement of frilly combs and tubercles and intervening deep lacunae of sinuous outlines. Many oscules are hidden inside the lacunae, but others are visible in prominent parts.

***Rhaphoxya felina* sp. nov.**

Plate 5 figure 4, plate 23 figures 3, 4,

text-figures 33–35

Holotype: F51964, Station KG 1 (Tasmania, West Cove, Erith Island, Kent Group; wreck of S.S. "Bullseye").

Diagnosis. Fist- or paw-shaped, firmly spongy, viscid. Dull orange to yellow in life. Surface verrucose-rugose in life. After preservation, thin dermis with tangential spicules largely collapses, surface then conulose to lacinulate and contorted-alveolate (deep pits formerly vestibules). Oscules on apical cones. Choanosome thoroughly cavernous. Spicular skeleton indistinctly reticulate-plumose, with many megascleres scattered interstitially.

Description. Like a mitten or feline paw: massive, erect, compressed, regularly expanding from narrow base to 4–5 apical osculiferous cones. Base not attached; side to mid-height with imprint and remnant of algal stalk used for attachment. Height 11 cm, width 4 × 9 cm. In life dull orange to chrome-yellow (7.5 YR7/10 to 2.5 YR8/10). Firmly spongy, viscid. Surface regularly verrucose with dendritic and meandering sulci. Semidiaphanous weak dermis now mostly collapsed, except base and some areas around top. Now exposed subdermal cavities circular to elongate-sinuuous to vermiculate (text-fig. 33), 1–2 mm wide, separated by contorted

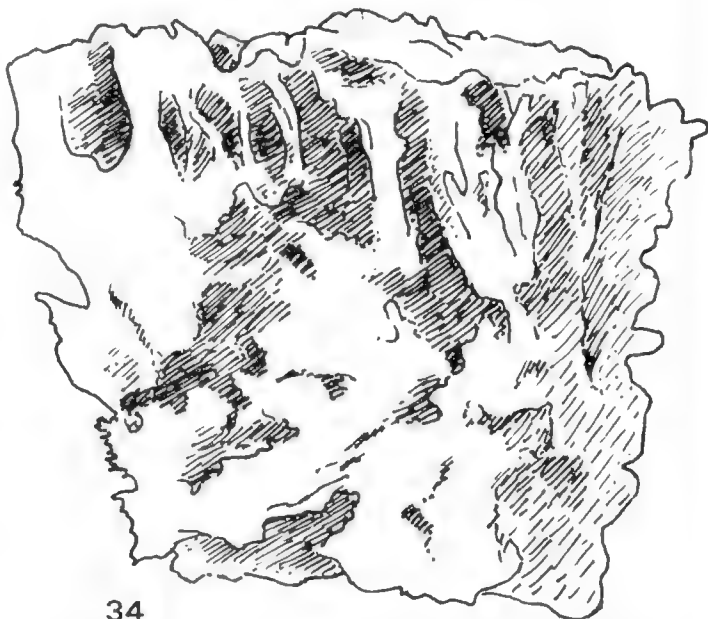
walls about half as wide. Labyrinthine pattern of walls with compound lacinules and conules at surface. Ostia scattered. Dermis with tangential spicules scattered, matted or in vague bundles. Oscules elongate to sinuous and vermiculate, on top of apical cones and on sides. Inhalant canals parallel in peripheral choanosome, perpendicular to oblique to surface; meandering and sinuous further in choanosome thus thoroughly cavernous (text-fig. 34). Megascleres of choanosome in branching and obliquely anastomosing plumose columns, and scattered in confusion interstitially, together with filiform spicules. Distinction between thinner branches, anastomoses and scattered megascleres frequently vague. Distinct principal spicular columns straight or vaguely sinuous, about 50 µm thick and 170 to 350 µm apart. Arrangement at surface, in edges, lacinules and conules of partitions, denser, matted or penicillate, plush-like.

Spiculation: (1) Oxea, straight, gently curved or bent, some slightly flexuous; hastate to slightly fusiform, points often conical; rare styles and styloids (anisoxea with one end blunt); 214–253–308 × 2.2–5.0–8.2 µm. (2) Filiform diactines, straight to slightly flexuous, 138–161–220 × 1–1.2 µm.

Remarks. *Rhaphoxya felina* is easily distinguishable from *R. cactiformis* by surface characteristics, by its delicate dermis, different skeletal structure, almost exclusive occurrence of regular oxea, and a distinct category of filiform diactines. *Rhaphoxya*



33



34

Figures 33, 34. *Rhaphoxya felina* sp. nov., details in reflected light, ×4. Figure 33. Surface with irregular subdermal spaces. Figure 34. Block sectioned from surface (above) showing the cavernous interior, with chiefly erect disposition of canals below surface.

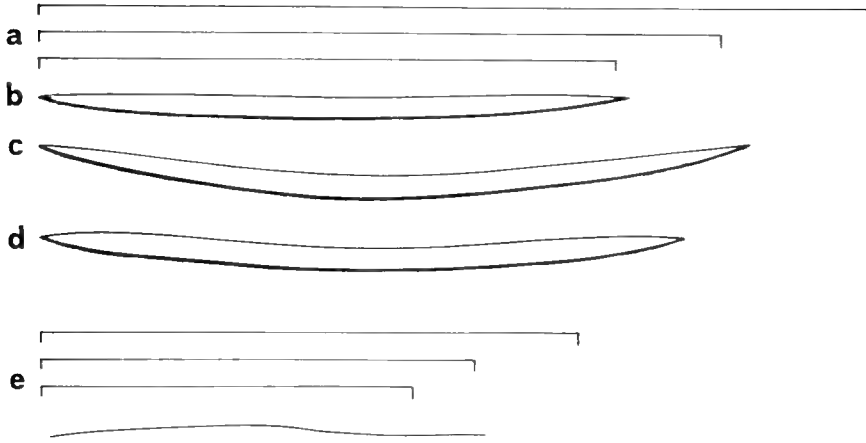


Figure 35. *Rhaphoxya felina* sp. nov., range and examples of spicules, $\times 327$. a-d. Oxea. e. Filiform diactines.

pallida (Dendy, 1897) and *R. typica* Hallmann (1917a) have a more substantial dermis than *R. felina*, and their choansome is denser, not as thoroughly cavernous as in this species. The spicular reticulum reinforcing the dermis of *R. typica* is coarse, visible without magnification.

The main skeletal structure of *R. pallida* and *R. typica* resembles that of *R. felina*, but the principal columns are more sinuous, and the surface plush of the latter is wanting. The chief difference resides in the average and maximum sizes of oxea and filiform diactines, which in *R. pallida* and *R. typica* are about twice those in *R. felina*.

Trachycladidae Hallmann, 1917

Synonyms: Spirophorellinae Lendenfeld, 1889 (nomen oblitum); Rhaphidistiinae de Laubenfels, 1936a.

Trachycladus Carter

Trachycladus Carter, 1879b: 343. — Hallmann, 1916a: 453 (definition, discussion). — Topsent, 1928: 37. — Bergquist, 1970: 21 (definition of family), 22 (discussion).

[*Spirophora*] Lendenfeld, 1887a: 794 (nec Milne-Edwards, 1836).

Spirophorella Lendenfeld, 1888: 236 (probably as nomen novum for *Spirophora*).

Diagnosis. The only genus in the family. Axinellida with spirocleres and commonly microrhabds.

Trachycladus laevispirulifer Carter

Plate 5 figure 5, text-figure 36

Trachycladus laevispirulifer Carter, 1879b: 343, pl. 28 figs 1-5 (South Australia). — Carter, 1885e: 357 (Port Phillip Heads). — Dendy, 1897: 245 (Port Phillip Heads). — Dendy, 1921: 107 (discussion of spirula). — Dendy, 1924: 378 (discussion). — Dendy and Frederick, 1924: 506 (Abrolhos Islands, WA; discussion).

Spirophora digitata Lendenfeld, 1887a: 794 (Port Jackson).

Spirophorella digitata. — Lendenfeld, 1888: 236 (old record).

Trachycladus digitatus. — Hallmann, 1914a: 268, 429 (discussion). — Hallmann, 1916a: 453, 466, text-figs 3, 4; pl. 22 figs 1, 2, pl. 23 fig. 1, pl. 26 fig. 2, pl. 27 fig. 1 (redescription from syntypes and hypotypes). — Lévi and Lévi, 1984: 942, text-fig. 8, pl. 1 fig. 6.

Spirophora bacterium Lendenfeld, 1887a: 795 (Western Port Bay, Vic.).

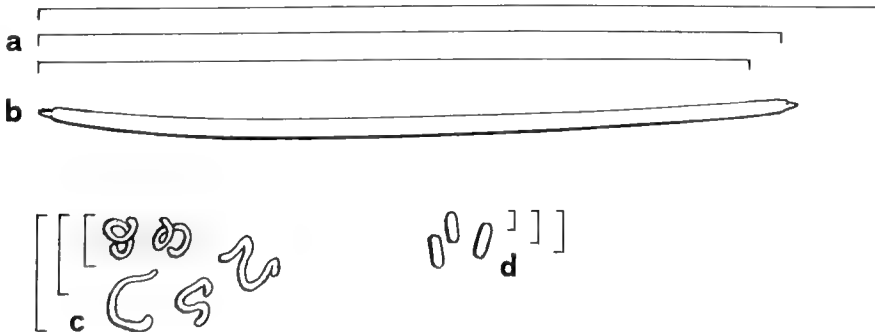


Figure 36. *Trachycladus laevispirulifer*, spicules. a, b. Range and example of megascleres, $\times 326$. c. Spirulae and sigmaspire, $\times 970$. d. Microrhabds, $\times 326$.

Trachycladus bacterium. — Hallmann, 1916a: 453–457, 486 (discussion).

Trachycladus scabrosus Hallmann, 1916a: 459, text-fig. 1, pl. 21 fig. 4, pl. 23 fig. 9, pl. 28 fig. 6 (off Port Jackson).

Trachycladus fastigatus Hallmann, 1916a: 462, text-fig. 2, pl. 21 fig. 1, pl. 23 fig. 10 (Great Australian Bight).

Trachycladus digitatus var. *gracilis* Hallmann, 1916a: 472, text-fig. 5, pl. 22 fig. 3, pl. 23 fig. 2, pl. 27 fig. 2 (Port Jackson).

Trachycladus digitatus var. *clavatus* Hallmann 1916a: 474, text-fig. 6, pl. 22 fig. 4, pl. 23 fig. 3, pl. 25 fig. 2, p. 27 fig. 3, pl. 28 fig. 5, pl. 29 fig. 1 (Port Phillip Bay, including hypotypes of Dendy, 1897).

Trachycladus digitatus var. *strongylatus* Hallmann, 1916a: 477, text-fig. 7, pl. 22 fig. 5, pl. 23 fig. 4, pl. 26 figs 3–6, pl. 27 fig. 4 (Port Phillip Bay).

Trachycladus reteporosus Hallmann 1916a: 479 (definition, discussion), 480, text-fig. 8, pl. 21 fig. 2, pl. 23 fig. 5, pl. 24 fig. 3, pl. 26 figs 1, 4, 7, pl. 27 fig. 5 (typical form, Port Phillip Bay); p. 482, pl. 21 fig. 3, pl. 23 figs 6–8, pl. 24 figs 1, 2, pl. 25 fig. 1, pl. 28 figs 1–4, pl. 29 fig. 2 (var. or varr., Port Phillip Heads, based on 10 hypotypes of Dendy, 1897, and one specimen in AM).

Trachycladus pustulosus Hallmann, 1916a: 486, text-fig. 9, pl. 21 fig. 5, pl. 26 figs 5, 8, pl. 27 fig. 6, pl. 39 figs 6, 7 (Port Phillip Bay).

Trachycladus styliifer Dendy, 1924: 377, pl. 12 fig. 7, pl. 15 figs 39–42 (Three Kings Island, New Zealand). — Bergquist, 1970: 21, pls. 5a, 10c (E of North Cape and Poor Knights Island, New Zealand).

Material examined. Station KG 7, one specimen (F51965). Type specimens of *Trachycladus laevispirulifer*, *Spirophora digitata*, *S. bacterium* (BMNH). Type specimens of *Trachycladus scabrosus*, *T. fastigatus*; *T. digitatus* varr. *gracilis*, *clavatus*, *strongylatus*; *T. reteporosus*, *T. pustulosus* (AM). Hypotypes of *Trachycladus laevispirulifer*: Carter, 1885e (BMNH), Dendy, 1897 (NMV).

Diagnosis. Prolifically branched, often bushy. Stalk and branches commonly terete, of variable length. Branches sometimes nodose, rarely anastomosed, often curved, commonly pointed, but very short ones may be blunt, club-shaped, laterally coalescent. Tough, flexible, elastic. Vermilion to bright orange in life. Surface smooth to rugo-reticulate, rugo-vermiculate or verrucose, occasionally hispid; lipostomous. Condensed axis of longitudinally packed oxea and/or styles with lateral thin, plumose columns oblique to surface. Little spongin in stalk. Interstitial spiroscleeres crowded, packed at surface. Microrhabds less abundant, often clustered.

Description. Small, thickly fan-shaped, with short stalk, expanded base, and short, repeatedly divided clavate branches, laterally coalescent, with ends mostly flush, few shorter ones jutting forward from one face. Firmly rubbery, vermilion in life.

Surface smooth with some vermiculate subdermal canals. No oscules.

Spiculation of branches: (1) Oxea, strongyles, styloids and styles, indistinguishable in size, 265–277–314 × 5–6.2–7.1 μm, curved, bent or flexuous, rarely straight. Oxea most frequent, hastate to slightly fusiform, commonly with telescoped points; styloids (strongyloxea, anisoxea with unequally mucronate points) moderately frequent; styles 1–2% of all megascleres, strongyles about equally scarce. (2) Spirulae, toxaspires and sigmaspires, mostly smooth, length 6.6–10.0–14.6 μm, width 5.1–5.9–7.2 μm, thickness 0.8–1.5 μm. C-shaped sigmaspires, especially little-curved ones, commonly thicker and finely tuberculate. (3) Microrhabds, smooth, occasionally faintly centrotolite, 6.4–12.4–15.3 × 0.7–2.6–3.8 μm.

Remarks. *Trachycladus laevispirulifer* is here conceived as a highly polymorphic species. As such it is the most thoroughly described and illustrated of all Australian sponge species (see synonymy). The new specimen is externally most similar to that described by Hallmann as *Trachycladus pustulosus*. Dendy (1924: 378) and Dendy and Frederick (1924: 506) doubted the justification of Hallmann's species and varieties and thought that all Australian specimens of *Trachycladus* should probably be included in *T. laevispirulifer*. *Trachycladus styliifer* is based on megascleres being almost exclusively styles. Dendy (1924) noted only a few strongyles, but no oxea. Bergquist (1970) recorded a proportion of 2% oxea in her material. In most of Hallmann's (1916a) descriptions, mention is made of scarce styles, which, however, seem to be wanting in the specimens assigned by him to *T. digitatus* var. *strongylatus* and *T. reteporosus*. In *T. digitatus* (typical form), Hallmann estimated the proportion of styles as being between 3 and 7%. In *T. digitatus* var. *strongylatus* and *T. reteporosus*, true oxea are rare, while strongyles and strongyloxea predominate. *Trachycladus styliifer* is therefore synonymised with *T. laevispirulifer*.

Raspailiidae Hentschel, 1923

Synonym: Euryponidae Topsent, 1928.

Remarks. In merging the Euryponidae with the Raspailiidae, I have followed Bergquist's view (1970: 26–32; 1978: 167). In the earlier instance, Bergquist has pointed out various insecurities, points of contention, and the need for revision, particularly within *Raspailia*. This report is not the place to discuss this matter any further, particularly since I am describing only one species in the family, in *Clathriodendron*, one of the less controversial genera.

Clathriodendron Lendenfeld

Clathriodendron Lendenfeld, 1888: 215. — Hentschel, 1911: 383 (synonymised with *Raspailia*). — Hallmann, 1912: 295 (discussion, retained). — de Laubenfels, 1936a: 102 (definition in *Raspailiidae*). — Bergquist, 1970: 30 (definition in *Raspailiidae*).

Diagnosis. *Raspailiidae* without axial or mesial condensation of skeleton, with strong development of reticulate spongin; fleshy dermis without special spicules. Outermost erect spicules of periphery protruding only from most prominent parts of surface.

Clathriodendron cacticutis (Carter)

Plate 5 figures 6, 7, plate 23 figure 5,
text-figure 37

Dictyocylindrus cacticutis Carter, 1885: 354 (Port Phillip Heads Vic.).

Raspailia cacticutis. — Dendy, 1896: 48 (Port Phillip Heads). — Pick, 1905: 35 (excluded from *Raspailia*). — Shaw, 1927a: 427 (Maria Island, Tasmania).

Aulospongos? cacticutis. — Dendy, 1905: 176 (tentative transfer only).

Clathriodendron cacticutis. — Hallmann, 1912: 297 (redescription of spiculation from type slide).

Material examined. Station KG 9, one specimen (F51966). Holotype, BMNH 1886.12.15.120 (wet, from Port Phillip Heads, ex J.B. Wilson collection).

Diagnosis. Flabellate, with thin, often contorted pedicel. Fronds around 1 cm thick, may be complex, radially folded, more or less deeply incised from upper margin. Both faces traversed by sparsely branching and anastomosing radial ridges, 1 mm wide, beset with numerous conules or lacinules up to 3 mm high. Intervening grooves 3 mm wide, mostly terete, transversely striate, bearing few scattered, small oscules. Rubbery, dark brown in life. Choanosome finely cavernous. Main skeleton reticulate, denser, richer in spicules at periphery, here with palisade of acanthostyles. Ridges and lacinules reinforced by longer fibres

cored by styles/subtylostyles, echinated by acanthostyles.

Description. From narrow pedicel, 2 cm long, a series of compressed, mostly flabellate branches diverge chiefly in one plane. These coalesce partly along edges, in fronds more or less deeply incised radially, with radial folds of variable width and depth. Two flabellate branches with parallel planes partly coalescent along radial portion of their inside. Total height 9 cm, total width when outstretched 13 cm. Thickness of fronds around 1 cm. Surface thrown into prominent thin ridges, chiefly radial, branching and anastomosing here and there, with uniform lacinules at equal intervals. Lacinules perpendicular, more frequently oblique upwards. Radial ridges 0.5–1 mm wide, about 3 mm apart. Length and spacing of lacinules 1–3 mm.

Dark brown (10 R3/2) in life, slightly faded in alcohol (2.5 YR4/2). Elastic, rubbery. Small oscules irregularly scattered, scarce, on one face of fronds, in furrows between ridges. Conspicuous fleshy, glabrous dermis. Tips of lacinules microhispid with protruding spicules. In furrows between ridges, dermis reinforced by faint reticulum of collagenous nervures, with transverse lines generally more prominent. Ostia within these meshes barely visible.

Choanosome regularly and finely cavernous. Mesial areas devoid of condensation, contain regular reticulation of spongin fibres with small polygonal meshes. Styles and acanthostyles less numerous here than further out, with little relation to fibres in placement and orientation. Mesial fibres 50–70 μm thick, with mesh sizes 135–175 μm . At periphery, almost continuous sheet or dense reticulum of spongin bears palisade of acanthostyles on outside. Inside ridges and lacinules, long primary fibres at intervals of 175–260 μm , cored by styles and subtylostyles, echinated by acanthostyles. The latter perpendicular or oblique outward. Dermis 65–700 μm thick, thinner on ridges. Outermost spicules not protruding except apices of lacinules.

Spiculation: (1) Styles and subtylostyles, straight, curved or bent, 395–513–591 \times 6.1–12.3–16.5 μm ; (2) acanthostyles with pointed to blunt ends, 90.9–100–123.5 \times 8.5–13–15 μm .

Remarks. *Clathriodendron arbuscula* Lendenfeld (1888, pl. 5 fig. 2, misidentified in the caption, fide Hallmann, 1912: 147, 297; 1914a: 267; redescribed by Hallmann, 1912: 296f.) is a distinct species, with proliferous thin branches, thinner conules, tylostyles larger than in *C. cacticutis*, and with a complement of oxea.

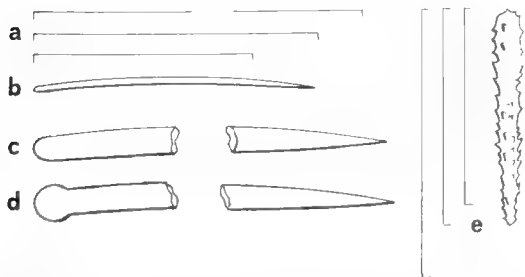


Figure 37. *Clathriodendron cacticutis*, spicules. a, b. Range and example of styles, $\times 67$. c, d. Enlarged ends of style and subtylostyle, $\times 261$. e. Acanthostyles, $\times 261$

Clathriodendron rubrum Kirk (1911), redescribed by Bergquist (1970: 31) has compressed-digitate branches, a surface without conules, styles and tylostyles of different sizes (the former very large) and oxea about twice the size of those in *C. arbuscula*.

The holotype of *C. cacticutis*, here figured for comparison (pl. 5 fig. 7), is much smaller than the present specimen, obviously immature, with conules little developed.

Subclass Ceractinomorpha Lévi, 1953

Order Poecilosclerida Topsent, 1928

Microcionidae Carter, 1875

Synonym: Clathriidae Lendenfeld, 1884.

Remarks. I have already established the priority of Carter's name (Wiedenmayer, 1977a: 139, with résumé on usage of both names), noting that the priority of *Clathria*, if accepted as a synonym of *Microcion*, has no bearing on the priority of the family name (ICZN, Article 40).

Lévi (1960: 50; 1973: 513) regarded the two family names (but not the respective type genera) as synonyms and chose Clathriidae (wrongly attributed to Hentschel, 1923), as valid, without giving reasons. Clathriidae sensu Lévi was used by most authors after 1960, but was never justified, with correct reference to the rules of nomenclature. Microcionidae was also used by Hechtel (1965: 41) and Hoshino (1981: 153), both in the sense of de Laubenfels. Van Soest (1984: 89) treated *Clathria* and *Microcion* as congeneric, but as distinct subgenera, and in this context treated *Clathria* as senior generic synonym, which is here accepted as correct. However, his choice of Clathriidae Lendenfeld, 1884 (wrongly attributed to Hentschel, 1923) as valid, in preference to Microcionidae Carter, 1875, breaches ICZN Article 40a and has to be rejected.

Clathria Schmidt

Clathria Schmidt, 1862: 57. — Ridley and Dendy, 1887: 146. — Dendy, 1905: 170. — Hallmann, 1912: 205. — Topsent, 1928: 62. — Burton, 1934a: 558 (excessive synonymy, discussion). — Lévi, 1960: 50 (résumé, definition). — Bergquist, 1965: 168 (discussion). — Wiedenmayer, 1977a: 140 (references, résumé). — Van Soest, 1984: 7, 90 (synonymy, definition, discussion).

Microcion Bowerbank, 1863c: 1109. — Lévi, 1960: 51 (résumé, definition). — Bergquist, 1965: 168 (discussion). — Wiedenmayer, 1977a: 140 (references, résumé). — Van Soest, 1984: 7, 90 (discussion, subgenus of *Clathria*).

Ophlitaspongia Bowerbank, 1866: 14. — Simpson, 1968a: 95 (synonymised with *Microcion*).

Wilsonella Carter, 1885c: 320. — Hallmann, 1912: 237 (definition, excessive revision). — Hallmann, 1920: 768

(revision, monotypic restriction). — Topsent, 1928: 62. — Topsent, 1930a: 24, 46 (2 Australian species added). — Van Soest, 1984: 7, 129 (synonymised with *Clathria*).

Antherochalina Lendenfeld, 1887a: 741, 786 (part, for exceptions see *Echinoclathria leporina*, below). — Burton, 1934a: 588 (revision). — Wiedenmayer, 1977a: 140 (references).

Clathriopsamma Lendenfeld, 1888: 227. — Hallmann, 1920: 771 (definition, discussion, review). — Vacelet, Vasseur and Lévi, 1976: 75 (discussion, *Aulenella* synonymised). — Van Soest, 1984: 129 (synonymised with *Clathria*).

Dictyociona Topsent, 1913a: 618. — Lévi, 1960: 60 (synonymised with *Clathria*). — Van Soest, 1984: 7, 129.

?*Dendrocia* Hallmann, 1920: 767. — Van Soest, 1984: 129 (synonymised with *Clathria*).

Leptoclathria Topsent, 1928: 61, 62, 298 (part, fide van Soest; type species vacant). — Lévi, 1960: 54 (synonymised with *Microcion*). — van Soest, 1984: 129.

Pseudanchinoe Burton, 1929a: 433 (monotypic). — de Laubenfels, 1936a: 109 (part). — Van Soest, 1984: 129.

Hymantho Burton, 1930a: 502. — Van Soest, 1984: 90, 130.

Aulenella Burton and Rao, 1932: 345.

Thalysouryon de Laubenfels, 1936a: 107. — Wiedenmayer, 1977a: 143, 144f. (as synonym of *Pandaros*). — Van Soest, 1984: 108, 128 (synonymised with *Clathria*).

Cionanchora de Laubenfels, 1936a: 108. — Van Soest, 1984: 7.

Quizciana de Laubenfels, 1936a: 111. — Van Soest, 1984: 130.

Wetmoreus de Laubenfels, 1936a: 112. — Van Soest, 1984: 130.

Diagnosis. Encrusting to erect and bushy Microcionidae with simple, dendritic or anastomosing spongin fibres cored by (acantho-)styles and echinated by distinct (acantho-)styles. Other (single) categories of special styles or tylostyles at surface, arranged paratangentially or piercing ectosome. Yet another category of styles or tylostyles may occur interstitially in choanosome, but may intergrade with ectosomal megascleres.

Remarks. The above synonymy follows chiefly that suggested and implied by van Soest (1984), who based his revision of the Poecilosclerida, and particularly of the Microcionidae, on taxonomic principles expressed in Table 1 (p. 7) and in the discussions of families and genera. In essence, he emphasises skeletal structure, and degrades habitus and spicular characters (chela-types (particularly discussed on p. 84), absence of spicule categories (p. 108), presence or absence of acantho-condition of megascleres, growth form). Simpson (1968a: 119, cited in Wiedenmayer, 1977a: 141) had devalued similar characteristics used as diagnostic in the past. Regarding the inclusion of

Ophlitaspongia, see Remarks on *Echinoclathria*, below.

***Clathria transiens* Hallmann**

Plate 5 figure 8, plate 23 figure 6,
text-figure 38

Clathria transiens Hallmann, 1912: 266; with four unnamed forms; form a (= typical form), p. 229, text-figs. 47, 47a, pl. 33 fig. 1 (off Devonport, Tas.); form b, p. 231, text-figs. 48, 48a, pl. 33 fig. 2 (40 mi. W of Kingston, SA); form c, p. 232, pl. 33 fig. 3 (same locality); form d, p. 233, pl. 34 fig. 2 (Port Phillip Bay, Vic.).—Burton, 1934a: 559 (discussion), 599 (Great Barrier Reef, record only).—Shaw, 1927a: 426 (Maria Island, Tas., record only).



Figure 38. *Clathria transiens*, spicules, $\times 263$. a. Choanosomal coring style. b. Peripheral coring style. c. Interstitial choanosomal style. d. Echinating style. e. Toxa.

Thalysias transiens.—de Laubenfels, 1936a: 105 (transfer only).

Material examined. Station KG 7, one specimen (F51980). Type specimens of *Clathria transiens* (AM).

Diagnosis. Erect, much branched, irregular, often bushy. Branches variable in length, rather thin, some anastomosing, mostly complex nodular and lacunose, frilly, with many lateral branchlets as long as thickness of main branches. Firm, elastic. Bright vermilion in life. Oscules inconspicuous. Spiculation (megascleres) variable, toxa often scarce, chelae may be very rare.

Description. Short stalk. Branches roughly in same plane, asymmetrical. Secondary branches short. Contorted rugae and nodules 0.5–2.8 mm wide, interstitial lacunae 0.4–1.6 mm wide. Main branches chiefly 5–6 mm thick, distally blunt.

Spiculation: (1) Choanosomal coring styles, rarely straight, commonly gently curved or bent, $126\text{--}149\text{--}180 \times 2.9\text{--}7.3\text{--}10.9 \mu\text{m}$. (2) Peripheral styles, coring and projecting through ectosome, $220\text{--}469 \times 7.6\text{--}8.5 \mu\text{m}$. (3) Interstitially scattered choanosomal styles, strongyles, tylostrongyles and tylostyles, mostly straight, some gently curved or bent, $156\text{--}234\text{--}327 \times 2\text{--}3\text{--}3.9 \mu\text{m}$. (4) Smooth or slightly roughened echinating styles and subtylostyles, $56\text{--}64\text{--}72 \times 2.1\text{--}2.7\text{--}3.6 \mu\text{m}$. (5) Toxa with straight or recurved arms, scarce, $96\text{--}145\text{--}157 \times 0.9\text{--}1.8\text{--}2.5 \mu\text{m}$. (6) Palmate chela (only one seen), $12.8 \times 4.7 \mu\text{m}$.

Remarks. The new specimen agrees in growth form with Hallmann's form c. Its colour in life was vermilion (SR5–6/12). The spiculation does not closely agree with any of Hallmann's forms and attests to the variability of this species.

***Clathria wilsoni* sp. nov.**

Plate 5 figure 9, plate 24 figure 1,
text-figure 39

Holotype: F51967, Station KG 5 (Garden Cove, N side of Deal Island, Kent Group, Tasmania; boulders with algae, much kelp).

Diagnosis. Small, with many crowded, short, nodular, angular, blunt branches from flat common base. Dull vermilion in life, spongy. Surface verrucose to hispid. Oscules small, sinuous, elongate, scattered. Reticulate skeleton of angular spongin fibres, typical megascleres. Microscleres raphidotoxa and rare atrophied chelae.

Description. Small; thickly encrusting base with irregular sinuous outline, 1×2 cm wide, 5 mm high, topped by 10–12 clustering, partly coalescent,

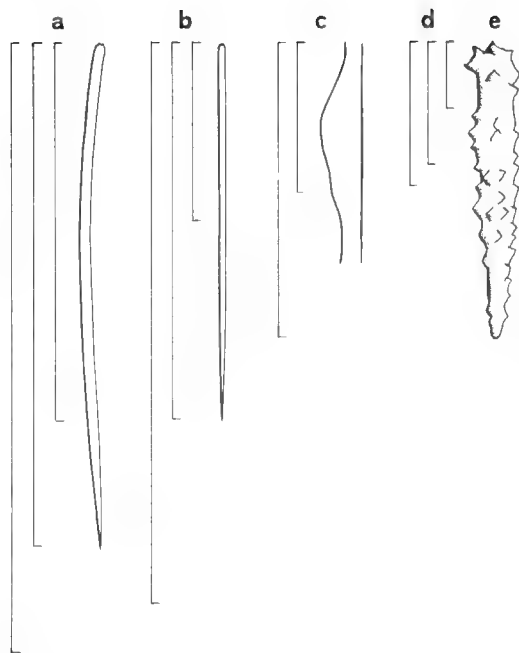


Figure 39. *Clathria wilsoni* sp. nov., spicules. a. Choanosomal coring styles, $\times 263$. b. Interstitial and ectosomal styles, $\times 263$. c. Rhaphidotoxa and thin strongyles, $\times 263$. d. Range of echinating acanthostyles, $\times 263$. e. Enlarged acanthostyle, $\times 788$.

stubby branches, 3–5 mm high, 2–3 mm wide. In life dull vermillion, yellowish around base. Consistency spongy.

Surface finely verrucose to hispid, the latter chiefly on branch-tips. Oscules small, commonly elongate, sinuous to vermiculate, scattered on base and sides of branches.

Choanosomal skeleton of spongin fibres, 18–35 μm thick, of angular disposition, with little orientation; irregular meshes of variable size, smaller ones round, larger ones rhombic to polygonal. Fibres always cored by styles and subtylostyles, one to eight abreast, echinated by short acanthostyles. Interstitially scattered thinner styles and subtylostyles, filiform diactines and rhaphidotoxa. Chelae extremely rare, atrophied. Interstitial styles form special dermal skeleton, in paratangential bundles and wide, regularly radiating penicils. Paratangential fibres just below surface commonly have most echinators on outside. Ascending fibres below surface occasionally with plumose arrangement of coring styles.

Spiculation: (1) Choanosomal coring styles and subtylostyles, commonly slightly curved or bent, mostly smooth, some roughened to faintly spinulate, $177\text{--}237\text{--}287 \times 2.4\text{--}4.8\text{--}7.4 \mu\text{m}$. (2) Interstitial and ectosomal styles, more frequently straight than gently curved or bent, $83\text{--}177\text{--}264 \times 1\text{--}2.2\text{--}3.3 \mu\text{m}$.

(3) Echinating acanthostyles, $31.6\text{--}57.2\text{--}67.2 \times 2.6\text{--}6.8\text{--}10 \mu\text{m}$ (width with spines). (4) Thin strongyles and rhaphidotoxa, with ends occasionally roughened, $71\text{--}137 \times 1\text{--}1.9 \mu\text{m}$. (5) One weak, atrophied chela (palmate?), $6.4 \mu\text{m}$ chord.

Etymology. The species is dedicated to Dr Barry Wilson, formerly Director of the Division of Natural History and Anthropology, Museum of Victoria, whose initiative made this study possible.

Remarks. Hallmann (1912: 215) segregated several species, mostly Australian, as a distinct group within *Clathria*, which he called the “*spicata*-group”. As characteristics of the group, he noted (1) imperfect differentiation of principal (coring) and accessory (echinating) megascleres, (2) participation of the former in the echination of the fibres, (3) semi-plumose or spicate arrangement of coring megascleres in the main fibres of the peripheral main skeleton, (4) absence of coring spicules from the connecting fibres, and (5) relatively dense echination on transverse fibres below the surface, chiefly on their outer side. *Clathria wilsoni* shows some traits outlined above, but the absence of others shows that the “*spicata*-group” is really an artificial one. In skeletal structure and spiculation, *Clathria wilsoni* shows most affinity with *Clathria costifera* Hallmann (1912: 215), particularly in the ectosomal skeleton without special spicules, presence of rhaphidotoxa, and lack of chelae in *C. costifera*. The external shape of the latter, however, is distinctive. Rhaphidotoxa also occur in *Thalysias juniperina* (Lamarck, 1814).

Echinoclathria Carter

Echinoclathria Carter, 1885e: 355. — Hallmann, 1912: 275f. (discussion, revision). — Wiedenmayer, 1977a: 143f. (references, discussion; not *Pandaros*).

Holopsamma Carter, 1885b: 211 (part). — nec sensu Loeblich and Tappan, 1964: C792 (under Xenophyophorida, wrong type species).

[*Halme*] Lendenfeld, 1885f: 285 (nec *Halme* Pascoe, 1869).

Aulena sensu Lendenfeld, 1888: 228. — Lendenfeld, 1889b: 90 (nec *Aulena* Lendenfeld, 1885f.).

Ophlitaspongia sensu auctorum (nec Bowerbank, 1866): Hallmann, 1912: 253 (discussion, revision). — Burton, 1959: 246 (key, list of 5 Australian species). — Wiedenmayer, 1977a: 140 (references).

Litaspongia de Laubenfels, 1954a: 162 (type species: *Ophlitaspongia arbuscula* Row, 1911).

Diagnosis. Microcionidae of variable shape, often thinly frondose or honeycombed, with generally reduced spiculation. Principal megascleres smooth styles or subtylostyles, coring or irregularly plumose to semi-echinating; auxiliary (interstitial) megascleres, if present, often filiform (strongyles

or subtylostongyles). Microscleres, if present, toxa and/or isochelae. Reticulate spongin fibres well developed, but may be obscured in some thoroughly sandy species, where proper spicules may be rare or lacking.

Remarks. Simpson (1968a: 95, 105) merged *Ophlitaspongia* in *Microciona*, on the basis of a re-examination of topotypes of the type species, *Ophlitaspongia papilla* Bowerbank (junior synonym of *Spongia seriata* Grant). This view is upheld here, but a new genus for *Ophlitaspongia* sensu auctorum is not necessary. Hallmann, in his discussion of *Echinoclathria*, admits that merging this genus and *Aulena* with *Ophlitaspongia* is equally feasible as keeping the latter distinct: "*Echinoclathria* is ultimately separable from *Ophlitaspongia* only by virtue of its characteristic honeycomb-like structure". The definition of *Ophlitaspongia* by Lévi (1960: 58, 64) emphasises spongin fibres containing quasi-echinating magascleres, without distinction of principal and accessory types, and absence of palmate isochelae. This obviously conforms largely with the diagnosis of *Ophlitaspongia seriata*. This virtually monotypic diagnosis is even more apparent though only implied, in van Soest (1984: 7, bottom), where incrusting habit is linked with *Ophlitaspongia*. In contrast, Burton (1959: 246), like Hallmann, included, in *Ophlitaspongia*, species without microscleres, species with isochelae and toxa, and species with toxa only. Species of *Echinoclathria* revised by Hallmann are mostly devoid of microscleres, but two contain isochelae.

Given the variability in shape within *Ophlitaspongia* sensu Hallmann and Burton, there seems to be little value in the "honeycomb-like mass of anastomosing flattened trabeculae" (Hallmann's diagnosis of *Echinoclathria*) as a diagnostic trait. A similar structure occurs in *Pandaros* (type species), but in that genus, as redefined by van Soest (1984: 127), spongin fibres may also be woven into continuous sheets. The latter structure also characterises *Echinoclathria tenuis* Carter (junior synonym of *Spongia leporina* Lamarck), the type species of *Echinoclathria* subsequently designated by Burton (1934a: 562, where the genus is merged in *Clathria*). Contradicting himself, and the rules of nomenclature, Burton (1934a: 599) transferred *E. tenuis* to *Ophlitaspongia*, maintaining this combination later (Burton, 1959: 246), in accordance with Dendy (1896: 37), Hallmann (1912: 261) and Topsent (1932a: 101). But his earlier subsequent designation is of course irreversible, except by plenary power of the International Commission on Zoological Nomenclature (ICZN Article 79).

Echinoclathria carteri Ridley and Dendy

Echinoclathria carteri Ridley and Dendy, 1886: 476. — Ridley and Dendy, 1887: 162, pl. 29 fig. 12, pl. 31 fig. 3 (Moncoeur Island, Bass Strait; Twofold Bay and off Port Jackson, NSW). — Hallmann, 1912: 284, text-fig. 65.

Echinoclathria macropora. — Whitelegge, 1907: 504 (off Botany Bay, off Coogee, off Wollongong, Shoalhaven Bight, NSW; nec *Plectispa macropora* Lendenfeld, 1888; nec *Echinoclathria macropora*: Whitelegge, 1901).

Axociella carteri. — de Laubenfels, 1936a: 119 (transfer only).

Material examined. Station KG 9 (record and colour-slide only).

Diagnosis. Long branches mostly simple, terete, around 1 cm thick, straight to bent or crooked, rarely conrescent. Surface regularly alveolate, with tabulate partitions around 1 mm, deep, rounded-polygonal pits 2–3 mm wide. Rubbery, dull orange-yellow when fresh, turning purplish brown. Stylole principals, $132 \times 9 \mu\text{m}$; subtylostylole auxiliaries, $160 \times 2 \mu\text{m}$; palmate isochelae 15 μm long.

Remarks. The single specimen was accidentally lost soon after collecting. But the field notes, colour slide, published descriptions, and plate 31, figure 3 in Ridley and Dendy, 1887, leave little doubt as to the proper identification of this specimen. The colour soon after collecting was noted as dull orange-yellow (7.5 YR7–8/6–8) with some areas becoming purplish brown after a while. The consistency was rubbery. For comparison, see Remarks on following species.

Echinoclathria favus Carter

Plate 5 figure 10, plate 24 figure 2,
text-figure 40

Spongia cellulosa. — Lamarck, 1814: 373 (nec *Spongia cellulosa* Esper, 1797; King Island, Bass Strait).

Echinoclathria favus Carter, 1885d: 292 (South coast). — Ridley and Dendy, 1887: 160, pl. 31, figs 4, 5 (Moncoeur Island, Bass Strait). — Dendy, 1896: 40 (old records). — Hallmann 1912: 276, text-fig. 61 (off Devonport, Tasmania). — Topsent, 1930a: 20, pl. 1, fig. 3 (redescription of *Spongia cellulosa*: Lamarck).

Axociella favus. — de Laubenfels, 1954a: 164 (transfer only).

Material examined. Station WB, one specimen (F51972). Type specimens of *Echinoclathria favus* (BMNH).

Diagnosis. Massive-lobate, small to medium-sized, commonly on *Pecten* or other large shells. Softly spongy to rubbery, light red to light orange in life. Surface contorted-honeycombed, with alveoles commonly 2–3 mm wide, partitions 1 mm and below. Some consecutive partitions lacking here

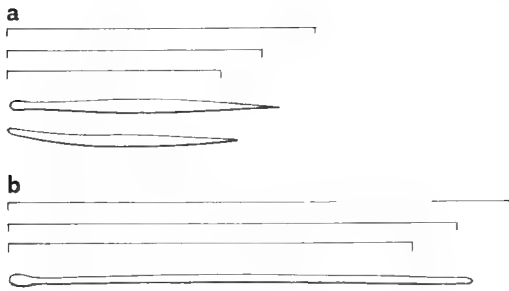


Figure 40. *Echinoclathria favus*, spicules, $\times 259$.
a. Range and examples of principal megascleres.
b. Range and example of auxiliary megascleres.

and there, pits then elongate, meandering. Principal megascleres mostly in 2 sizes.

Description. Contorted-lobate, dimensions $6 \times 7 \times 10$ cm. Honeycombed surface comparable to both specimens figured in Ridley and Dendy, 1887. Cellular spaces more regular, with slightly thinner partitions; characteristic lack of anastomoses and resulting meandering lacunae infrequent. Common association with *Pecten* not noted. In life light red (7.5 YR7/10–12) above, light orange (2.5 YR8/8) below. Softly spongy to rubbery. Skeleton a meshwork of clear to faintly stratified spongin fibres, with principal fibres in plane of lamellae. Principal fibres terete, straight to crooked, sparsely branched, $35\text{--}60\text{ }\mu\text{m}$ in diameter. Transverse (connecting) fibres frequently oblique and bent, around $20\text{ }\mu\text{m}$ thick. Meshes small, round (width in the order of fibre-diameters) to irregularly polygonal, up to $100\text{ }\mu\text{m}$ wide. Principal megascleres indistinctly segregated in two categories. Distribution of larger ones inconsistent, rare in some portions of meshwork.

Where frequent, larger styles are both/either coring, 1–5 abreast, with angular course, and/or oblique, in plumose to semi-echinating arrangement, the whole irregular. Outermost transverse fibres mostly free, tapering to surface, often echinated at tips with protruding styles. Thinner principal megascleres everywhere, in fibres and interstitially. Auxiliary megascleres strongyles, interstitial only. Chelae (described and figured by Ridley and Dendy, and Hallman) not found.

Spiculation: (1) Principal megascleres, larger ones as fusiform subtylostyles, slightly constricted below head, thinner ones with narrow heads, approaching anisoxea, overall dimensions $69\text{--}83\text{--}99 \times 2\text{--}3.3\text{--}4.8\text{ }\mu\text{m}$. Disregarding rare transitional types, two categories: $80\text{--}88\text{--}99 \times 3.3\text{--}3.8\text{--}4.8\text{ }\mu\text{m}$, and $69\text{--}75\text{--}79 \times 2\text{--}2.5\text{--}3.1\text{ }\mu\text{m}$, respectively. (2) Auxiliary megascleres, as strongyles and subtylostongyles, the latter faintly fusiform, with subter-

minal constrictions and terminal swellings elongate and indistinct, $132\text{--}146\text{--}163 \times 1.4\text{--}1.6\text{--}2.1\text{ }\mu\text{m}$.

Remarks. This *Echinoclathria* is distinct from other honeycombed species without sand inhabiting the same area (*E. carteri* Ridley and Dendy, *E. glabra* Ridley and Dendy) by its light red-orange colour; from the former by its massive habit, from both by the tendency of some neighbouring pits to merge in meandering trenches, and its common association with large shells, especially *Pecten*. Megascleres are generally larger in the other two species. The auxiliaries of *E. glabra* were originally described as "smooth bicapitate cylindricals" (presumably subtylotes).

Echinoclathria laminaefavosa (Carter)

Plate 5 figure 11, text-figure 41

Holopsamma laminaefavosa Carter, 1885b: 212 (Port Phillip Heads, Victoria).

Halme nidus vesparum Lendenfeld, 1885f: 288, pl. 26 figs 1, 2; pl. 27 figs 4, 5, 7; pl. 28 figs 8, 9, 11; pl. 29 figs 12, 13 (Port Phillip Bay, Vic.; Port Jackson, NSW). — Lendenfeld, 1888: 157 (Port Stephens, NSW). — Lendenfeld, 1889b: 457, pl. 11 figs 1, 7, 9, 10, 15–18. — Whitelegge, 1889: 184 (Maroubra Bay, NSW)

?*Echinoclathria favus* var. *arenifera* Carter, 1885c: 350 (south coast?).

?*Echinoclathria arenifera*. — Dendy, 1896: 40 (Port Phillip Heads, Queenscliff jetty, Vic.). — Shaw, 1927a: 426 (Maria Island, Tas.).

Halme laxa Lendenfeld, 1886a: 845 (collective name for 2 varieties, no nominotypical subspecies).

Halme laxa var. *minima* Lendenfeld, 1886a: 847 (Port Jackson).

Halme laxa var. *digitata* Lendenfeld, 1886a: 847 (Port Jackson).

Aulena laxa. — Lendenfeld, 1889b: 95 (collective name). — Whitelegge, 1889: 187 (off Green Point and off Ball's Head, Port Jackson). — Dragnewitsch, 1906: 442 (Pulu Brani, Singapore). — Hallmann, 1912: 287 (2 syntypes re-examined). — Hallmann 1914a: 268 (partial synonymy). — Burton, 1938: 20 (Maria Island, Tas.).

Aulena laxa var. *minima*. — Lendenfeld, 1888: 228. — Lendenfeld, 1889b: 96, pl. 8 figs 10, 11, 21.

Aulena laxa var. *digitata*. — Lendenfeld, 1888: 229. — Lendenfeld, 1889b: 96, pl. 8 figs 12, 15, 20; pl. 9 fig. 1.

Halme gigantea Lendenfeld, 1886a: 848 (collective name for 3 varieties).

Halme gigantea var. *micropora* Lendenfeld, 1886a: 849 (nec *Halme micropora* Lendenfeld, 1885f; Illawarra, NSW).

Halme gigantea var. *intermedia* Lendenfeld, 1886a: 849 (Broughton Island, NSW).

Halme gigantea var. *macropora* Lendenfeld, 1886a: 850 (east coast).

Aulena gigantea. — Lendenfeld, 1889b: 97 (collective name). — Whitelegge, 1889: 187 (off Green Point, Port Jackson). — Hallmann, 1914a: 268 (partial synonymy). — Burton 1938: 20 (Maria Island, Tas.).

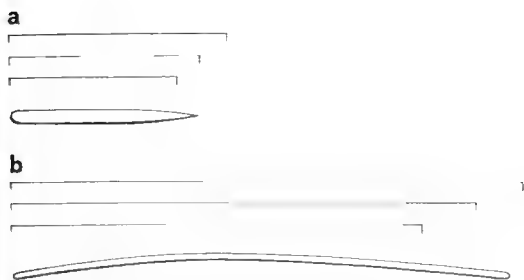


Figure 41. *Echinoclathria laminaefavosa*, spicules from F51969, $\times 395442$. a. Range and example of principal styles. b. Range and example of auxiliary megascleres.

Aulena gigantea var. *micropora*. — Lendenfeld, 1888: 232. — Lendenfeld, 1889b: 100, pl. 9 fig. 2. — Whitelegge, 1901: 93, 118 (Tuggerah Beach, Port Jackson, Maroubra Bay, NSW). — Whitelegge, 1907: 504 (off Barranjoey, NSW). — Guiler, 1950: 10 (Blackmans Bay, Tas.).

Aulena gigantea var. *intermedia*. — Lendenfeld, 1888: 232. — Lendenfeld, 1889b: 100, pl. 8 figs 3, 4, 7, 8, 18, 19; pl. 9 figs 3, 4.

Aulena gigantea var. *macropora*. — Lendenfeld, 1888: 231 (Fremantle, WA; Port Jackson, NSW). — Lendenfeld, 1889b: 99. — Whitelegge, 1889: 187 (off Green Point, Port Jackson).

Halme irregularis Lendenfeld, 1889a: 49 (in key). — Lendenfeld, 1889b: 453 (collective name for two varieties, no nominal subspecies).

Halme irregularis var. *lamellosa* Lendenfeld, 1889a: 49 (in key). — Lendenfeld, 1889b: 454, pl. 11 fig. 3 (Port Phillip Bay, Vic.).

Halme irregularis var. [*micropora*] Lendenfeld, 1889a: 49 (in key, nec *Halme micropora* Lendenfeld, 1885f). — Lendenfeld, 1889b: 455, pl. 9 fig. 8 (Port Phillip Bay, Port Jackson).

Material examined. Station KG 1, one specimen (F51969); station KG 5, two specimens (F51970, F51971). Type specimens of *Holopsamma laminaefavosa* (BMNH); of *Halme nidusvesparum*, *H. laxa* varr. *minima* and *digitata*; *Aulena laxa* varr. *minima* and *digitata*; *Halme gigantea* varr. *micropora*, *intermedia* and *macropora*; *Halme irregularis* varr. *lamellosa* and *micropora* (AM and BMNH).

Diagnosis. Massive, cake-shaped to lobose, or thickly digitate, light to dull orange-brown, easily torn, thoroughly honeycombed; always full of sand. Proper spicules may be rare or lacking. Very common in Bass Strait.

Remarks. As with *Trachycladus laevispirulifer*, the extensive synonymy reflects the polymorphism of this species. The variability relates to general shape (massive, cake-shaped to globular or lobose, coarsely digitate), regularity or irregularity of the honeycombed, lacunose or lamellate surface pattern, prevailing width of compartments, relative width of partitions. With regard to skeletal structure, variability affects relative abundance of spon-

gin, foreign debris and proper spicules; presence or absence of orientation of fibres and of their differentiation into primaries and secondaries, specialisation in the periphery and at the surface. Where differentiation and orientation of fibres prevails in the main skeleton, debris may be agglutinated in columns, or may be encased in knotty fibres. Where specialisation below and at the surface is developed, principal specules (styles) seem to be frequent. They echinate the outermost paratangential fibres on the outside and may echinate free fibres ascending to the surface, or may be arranged in plumose columns without spongin. A sandy dermis may or may not be developed. These traits are based on Lendenfeld's observations and figures (1889b, pl. 8 in particular; the tangential dermal spicules in fig. 7 are more likely foreign).

Either principal or auxiliary megascleres, or both, may be rare or wanting. *Aulena* and *Halme* sensu Lendenfeld (1889b), the latter without *Halme* (formerly *Aulena*) *villosa* (a *Dysidea*), are in practice indistinguishable except for virtual or total lack of proper spicules in "*Halme*".

Echinoclathria arenifera Carter is here treated as a doubtful synonym because of its principal megascleres having been described as fusiform subtylostyles (like those in *E. favus*), while those in *E. laminaefavosa* are hastate. Dendy (1896) noted proper spicules in three of his specimens but probably none in two other ones.

The present specimens are palm-to hand-sized, cake-shaped. F51969 and F51971 are of the "*laxa*-type", having wide, rather irregular compartments, with partitions thin in the former, intermediate in the latter. F51970 is of the "*irregularis*-type", with very wide compartments and contorted partitions extending into partly free lamellae. The colour in life was noted as dull orange (5 YR8/6) in F51970, a deeper orange (5 YR7-8/10-12) in F51971.

Spiculation: Only dissociated preparations. F51969 has frequent styles among foreign debris, $52.6-60.5-68.1 \times 2-2.9-3.7 \mu\text{m}$. Auxiliary megascleres: bent to flexuous strongyles, with wide axial canal, $128-145-160 \times 1.7-2-2.2 \mu\text{m}$, about 10% of all proper megascleres. In other two specimens only auxiliaries as proper megascleres, mostly subtylostrostrongyles, weakly mineralized and flexuous, $148-0.9-1.8 \mu\text{m}$ in F51970, $155-160 \times 1-1.5 \mu\text{m}$ in F51971.

Echinoclathria leporina (Lamarck)

Plate 6 figure 1, plate 24 figures 4, 5,

text-figure 42

Spongia leporina Lamarck, 1814 (1813–1814): 444 (Southern Seas).

Echinoclathria tenuis Carter, 1885e: 355 (Port Phillip Heads, Vic.).

Ophlitaspongia tenuis. — Dendy, 1896: 37 (revision; Port Phillip Heads). — Hallmann, 1912: 261, text-fig. 56, pl. 35 fig. 1 (Port Phillip Bay; W of Kingston, SA). — Topsent 1932a: 101, pl. 6 fig. 1 (redescription of holotype of *Spongia leporina*; discussion). — Burton, 1934a: 599 (Great Barrier Reef).

nec *Clathria tenuis*. — Hentschel, 1911: 377, text-fig. 49 (fide Hallmann, 1912).

Phakellia papyracea Carter, 1886g: 379 (Western Port Bay, Vic.; fide Dendy, 1896; nec *Phakellia papyracea* Ridley and Dendy, 1886, = *Phakettia wellsi* de Laubenfels, 1936a, nomen novum, here transferred to *Axinosia*).

Antherochalina perforata Lendenfeld, 1887a: 788 (part?), pl. 22 fig. 44 (Broughton Island, NSW). — Lendenfeld, 1888: 89. — Whitelegge, 1902b: 279, 287 (part: schizoholotype and two doubtful "syntypes" redescribed). — Burton, 1934a: 558 (holotype revised: synonymised with *Ophlitaspongia tenuis*).

Antherochalina tenuispina Lendenfeld, 1887a: 789 (Western Port Bay, Vic.). — Hallmann 1912: 265 (schizoholotype re-examined). — Burton, 1934a: 558 (holotype revised: synonymised with *Ophlitaspongia tenuis*).

Material examined. Station KG 6, one specimen (F51973); station KG 7, two specimens (F51974, F51968). Holotype of *Echinoclathria tenuis* (BMNH); type specimens of *Phakellia papyracea* (BMNH); holotypes of *Antherochalina perforata* and *A. tenuispina* (BMNH).

Diagnosis. Complex-frondose, with terete, basally expanded stalk. Fronds 2 mm thick, distally lobate, incised to variable depths, occasionally lacunose; their surface in large specimens with radial and concentric ribs. Rubbery in fronds, firm in stalk. Vermilion, with thin pale coat in places. Oscules scanty, commonly stellate with branching, radial subdermal canals. Fibro-reticulate and spicular skeleton tending to radial-penicillate differentiation in periphery and surface. Megascleres typical, no

microscleres.

Description. F51973 small, 6 cm high; main frond 2.8 cm wide, bears two small secondary fronds on upper half. Growth lines and radial striation barely perceptible. Other specimens like Lamarck's holotype, as figured by Topsent, but both comprise more of the distally incised palmate branches. Height of F51974, 33 cm, that of F51968, 20 cm. Fronds marked by irregular pattern of longitudinal ridges, truncated or alternating along transverse growth lines in form of swellings curved parallel to frond margins. Pattern more pronounced than on Topsent's and Hallman's illustrations. On largest specimen, some ridges branch and/or anastomose, and may extend into small secondary fronds, more often longitudinal, occasionally transverse. Same surface-structure modified into a rugoreticulate pattern in one area. Fronds, where almost smooth, 1–2 mm thick. In largest specimen, fronds pierced by few round lacunae, 1–3 mm wide. Some are submarginal and partly open, like in *Antherochalina perforata* as figured in Lendenfeld (1887a).

In life vermilion (7.5 R6/12), with thin paler coat in some places (7.5 R7/10). Rubbery to leathery, hard in stem. Oscules scanty and surrounded by radiating, dendritic-confluent subdermal canals in life, pattern invisible in alcohol. Ostia conspicuous, regularly scattered in depressions on both sides of fronds. In small specimen (pl. 24 fig. 5), mesial region comprises a tight subisodictyal reticulation of thick yellow spongin fibres, with rounded meshes equal in width or smaller than fibre-diameters, encasing principal megascleres of narrow size-range ($73\text{--}97 \times 3.2\text{--}5.7 \mu\text{m}$), with rare larger principal and auxiliary megascleres. Few fibres somewhat longer and multispicular. Peripheral skeleton with distinct ascending and paratangential fibres, larger meshes, pale spongin, principal megascleres of wide size-range, and

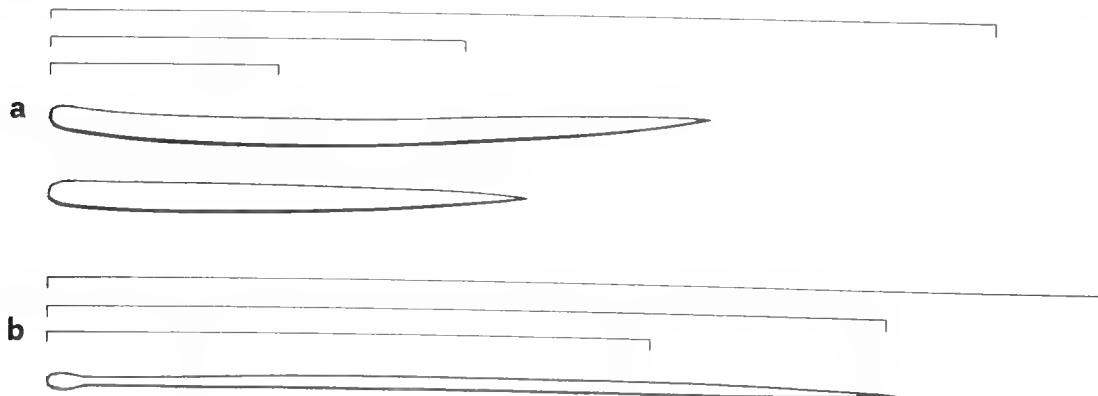


Figure 42. *Echinoclathria leporina*, spicules from F51974, $\times 402414$. a. Range and examples of principal styles. b. Range and example of auxiliary subtylostyles.

numerous auxiliary megascleres, of which outermost tend to be arranged perpendicular to surface.

In largest specimen, spongin meshwork of mesial region wider, multispicular fibres common; intermediate and larger principal, and auxiliary megascleres abound. In periphery, auxiliary megascleres scattered at random below dermis, chiefly paratangentially in dermis, between regularly hispidating outermost principal styles (pl. 24 fig. 4).

Spiculation (F51973): (1) Principal styles and subtylostyles, rarely straight, mostly curved or flexuous, $69\text{--}124\text{--}281 \times 3.2\text{--}5.3\text{--}9.4 \mu\text{m}$. (2) Auxiliary subtylostyles, mostly straight, occasionally flexuous, $179\text{--}249\text{--}312 \times 2\text{--}2.4\text{--}2.9 \mu\text{m}$.

Remarks. The skeletal structure agrees in general with Hallmann's detailed description. The variations ascribed by this author to age and growth stages within the same specimen could not be observed, mostly because time did not permit multiple sectioning. Variations of a similar kind were observed in transverse sections of specimens F51973 (small) and F51974 (largest). The differences could equally be individual, or the result of unequal orientation with respect to longitudinal ribs (not observed in sectioning).

Echinoclathria globosa (Lendenfeld)

Plate 6 figures 2–5, 7, text-figure 43

Holopsamma crassa Carter, 1885b: 211 (part: at least 6 of 31 syntypes; Port Phillip Heads, Vic., below 20 fm). *Aulena crassa*. — Lendenfelds, 1889b: 101, pl. 8 figs 1, 2, 5, 6, 22, 23; pl. 9, figs 5, 9 (description and figures from unspecified Carter syntypes).

nec *Psammopemma crassum*. — Lendenfeld, 1889b: 638 (partly based on other unspecified Carter syntypes of *Holopsamma crassa*).

Echinoclathria crassa. — Hallmann, 1912: 287 (discussion, wrong conclusions).

Halme globosa Lendenfeld, 1885f: 303 (Port Phillip Bay, Vic.; St. Vincent Gulf, SA, shallow water). — Lendenfeld, 1888: 157 (old records). — Lendenfeld, 1889b: 456, pl. 9 fig. 11.

Halme micropora Lendenfeld, 1885f: 304 (Illawarra, near Wollongong, NSW, on beach). — Lendenfeld, 1888: 159 (old record). — Lendenfeld, 1889b: 461, pl. 9 fig. 12, pl. 11 fig. 4 (not synonyms, old record).

Material examined. Station KG 4, four specimens (F51975, F51976, F51977, F52077). Type specimens of

Holopsamma crassa (BMNH, see table 1), *Halme globosa* (BMNH), *Halme micropora* (AM and BMNH). For comparison: holotype of *Phoriosopongia reticulum* Marshall, 1880 (ZMB, with schizotype and slide).

Diagnosis. Small, round to irregularly lobate, thoroughly sandy, more or less deeply pitted to lacunose. Pits and lacunae round to elongate, some contorted, mostly 1–3 mm wide; tabulate to convex interstices of similar width. Pits may be covered by recessed sandy dermis bearing central oscule. Internally cavernous. Firm, easily broken. Greyish buff to yellow, finely mottled by coarse sand. Small, thin strongyles only (?)

Description. Specimens contiguous in life, small, largest (F51975) 5.5 cm in greatest dimension. This specimen (pl. 6 fig. 2) the most regular, cocoon-shaped, growing around several branches of brown alga. Other three specimens irregularly lobate. Lacunose pattern more regular in largest specimen, with round to elongate openings, sharp, flush to slightly recessed rims; irregularly cavernous interior. Some elongate openings contorted, often like footprints. Tabulate to slightly convex interstices about equal in width to lacunae. in F51977 and F52077, interstices discontinuous in some areas, lacunae larger, winding or sinuous. F51976 (pl. 6 fig. 3) has most lacunae closed by deeply concave fleshy dermis, reinforced by scattered sand grains, occasionally pierced by a small oscule. Some of these pits are composite, petaloid.

In alcohol greyish buff to yellow, finely mottled by sand grains, difficult to grade (about 10 YR – 2.5 Y7–8/6). In alcohol firm to hard, moderately to barely compressible, easily broken. Sand always coarse, packed at surface, irregularly scattered to crowded internally. No detailed observations on skeletal structure.

Spiculation: Only dissociated preparation (F51977): thin strongyles, straight to slightly bent or flexuous, $127\text{--}137\text{--}148 \times 1\text{--}1.3 \mu\text{m}$.

Remarks. The polymorphic concept of this species, as reflected in the synonymy given above, needs to be justified and clarified, albeit provisionally, with reference to the confused history of past descriptions, and to what I know of the type material involved.

Carter's description of *Holopsamma crassa* is quite ambiguous and unsatisfactory, considering the notorious taxonomic difficulties affecting the Australian sandy sponges. The extant type series of *Holopsamma crassa* is certainly composite; though only macroscopic examination was possible during my survey at the British Museum (May, 1983), at least five species are obviously



Figure 43. *Echinoclathria globosa*, spicules from F51977. Interstitial strongyle, the only type found, $\times 390$.

represented. In Carter's manuscript catalogue of sponges from Port Phillip Heads and Western Port Bay (J.B. Wilson collection), identified and described by him, and deposited with the type specimens, 24 syntypes (of which one wet, 23 dry) are listed for *Holopsamma crassa*. According to the BMNH register and specimen labels, 31 specimens are now catalogued (not all of which were found during my survey). Though some mistakes are known to occur in Carter's catalogue, it seems more likely that some specimens were broken (accidentally or for study) and fragments subsequently registered separately in the British Museum. The results of my survey of this type series are represented in table 1.

Lendenfeld (1889b), who had examined most, if not all syntypes of *Holopsamma crassa*, described two different species based on largely unspecified syntypes of Carter. He compounded the confusion by using Carter's specific name for both species. *Aulena crassa* sensu Lendenfeld is obviously identical with *Echinoclathria globosa*, as here understood, as particularly some of his figures (pl. 8 figs 1, 2; pl. 9 figs 5, 9) suggest. The figures of plate 8 are diagrammatic, and those on plate 9 could not be matched with any specimens I have examined, hence are probably of specimens not found in the dry systematic collection. The other species, described by Lendenfeld as *Psammopemma crassum*, without figures, is more puzzling. It is partly based on unidentified Carter syntypes (more likely among those not found), partly on specimens of his own, none of which I could trace during my surveys in Sydney, London, and East Berlin. The description is suggestive of a *Phoriospongia* without, or with overlooked proper spicules, or, perhaps, of a *Psammoclema* as understood below. But its status as a good species, and hence the need for a replacement name, are doubtful at present, contrary to the allegation in Hallmann (1912: 287).

It could be argued that a lectotype of *Holopsamma crassa* should be designated from among the two specimens illustrated by Lendenfeld (1889b, pl. 9), in which case *crassa* (published in March) would have priority over *globosa* (published after July). That specimen, however, has to be identified first as extant, and re-examined, including spiculation. In the meantime, it seems safer to use *globosa*, the holotype of which, previously known only from Lendenfeld's inadequate figure, is here figured anew (pl. 6 fig. 4).

The polymorphism of *Echinoclathria globosa*, as here conceived, is apparent in (1) the conformation of the surface: regularity in distribution and contours of lacunae, relative width and convexity of interestices, presence or absence of a dermis tympanising or recessed in the lacunae, with or without

regular central oscules, smooth or reinforced by sand grains; (2) degree and regularity of interior cavernosity; (3) presumed absence of either principal styles or auxiliary strongyles, or both (in analogy to *Echinoclathria laminaefavosa*); and (4) variability of spicule dimensions (Lendenfeld indicated $200 \times 3 \mu\text{m}$ for strongyles).

A final word of caution is needed with regard to *Phoriospongia reticulum* Marshall, which is externally indistinguishable from *Echinoclathria globosa*. The holotype (pl. 6 fig. 6), from Tasmania, could be re-examined from a schizotype, through the kindness of Dr and Mrs D. Kühlmann, Curators in charge, Museum für Naturkunde der Humboldt-Universität East-Berlin. Its spiculation is distinctive: (1) Strongyles, mostly modified to subtylostongyles, subtylotes, and (rarely) tylostongyles, variably curved, bent or flexuous, $204\text{--}222\text{--}235 \times 1.9\text{--}2.4 \mu\text{m}$; (2) sigmata, often contorted, very abundant interstitially (pl. 24 fig. 3), $22.3\text{--}30.8\text{--}36.3 \times 1.2\text{--}2.4 \mu\text{m}$.

Echinoclathria egena sp. nov.

Plate 6 figure 8, plate 24 figure 6,
plate 25 figures 1,2, text-figure 44

Holotype: F51978, Station KG 6 (Tasmania, Winter Cove, E side of Deal Island, Kent Group; boulders with algae, depth 3–6 m).

Diagnosis. Encrusting, lobate and bullate base with short, knotty, compressed, irregular branches. Oscules conspicuous, numerous, raised, scattered. Spongy to limp. Dull orange when fresh, turning purplish brown. Surface smooth. Regular fibre net, mostly condensed in periphery. Megascleres typical but small, principals coring primary fibres only. No microscleres.

Description. From incrusting base of irregular, sinuous outline, 1–5 mm thick, several knotty and compressed branches arise, mostly oblique, contorted, up to 4 cm long, 0.3 to 2.5 cm wide. Oscules conspicuous and numerous on base and branches, mostly raised on volcano-shaped or bullate eleva-

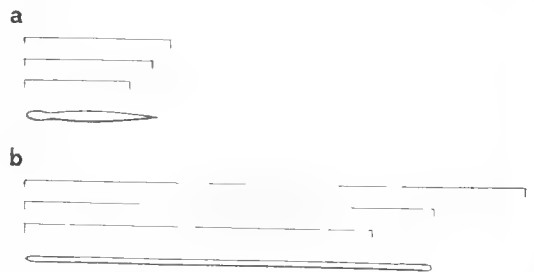


Figure 44. *Echinoclathria egena* sp. nov., spicules, $\times 342$. a. Range and example of coring styles and subtylostyles. b. Range and example of interstitial strongyles.

Table 1. Type series of *Holopsamma crassa* Carter in the British Museum (Natural History).

BMNH register number	Preservation	Location in type collections	Additional MS. entries on label ¹	Present interpretation, remarks
86.12.15.58	wet	4.IV.A	"= <i>Ancorina</i> . . ." (R.K. 21/7/08)	<i>Ancorina</i> sp., has sandy cortex
86.12.15.313, -314, -316	dry	K. 63	"92, 12, 39" (H.J.C.), " <i>Holopsamma tuberculata</i> " and " <i>Psammopemma tuberculata</i> var." (Ldf.)	<i>Echinoclathria globosa</i> (Ldf); 86.12.15. 313 here figured, pl. 6, fig. 7
86.12.15.315	dry	not found		
86.12.15.317	dry	K. 63	"54" and "PW11" (H.J.C.), " <i>Holopsamma tuberculata</i> " and " <i>Psammopemma tuberculata</i> var." (Ldf.)	<i>Psammoclema densum</i> (Marshall)
86.12.15.318	dry	K. 63	"103" and remark on colour in life (H.J.C.) " <i>Holopsamma fuliginosa</i> " (Ldf). " <i>Psammopemma fuliginosum</i> "	<i>Psammoclema fuliginosum</i> (Carter)
86.12.15.409	dry	not found		
86.12.15.410	dry	K. 37	"21" (H.J.C.), " <i>Dys. rugosa</i> " (Ldf.)	<i>Echinoclathria globosa</i>
86.12.15.411	dry	not found		
86.12.15.412	dry	K. 62	"52" and "conulated" (H.J.C.)	<i>Phoriospongia wilsoni</i> (Dendy)
86.12.15.426-430	dry	K. 62	"10" (H.J.C.)	<i>Phoriospongia wilsoni</i> (Dendy); in box, possibly 5 fragments of 1 specimen
86.12.15.431	dry	not found		
86.12.15.474-487	dry	not found		14 syntypes

¹ H.J.C. = Carter; Ldf. = Lendenfeld; R.K. = Kirkpatrick.

tions, 1-2 mm wide, some smaller. Mostly restricted to edges of branches, some scattered on one face of wider branches. In life dull orange (5 YR7-8/12), turning dark purplish brown (5 R3/8) in elevated areas when drying. Spongy, moderately firm in branches, limp in base.

Choanosome dense, but base contains conspicuous meandering canals, 3 mm wide. Surface optically smooth, but slightly rough, micropapillate with protruding ends of primary fibres. Ostia mostly conspicuous, regularly scattered inside out-

ermost tangential meshes of peripheral skeleton. Meshwork of strong spongin fibres regular, particularly in outer portion. Primary fibres 27-52 μ m in diameter, thicker at surface; secondaries 16-40 μ m in diameter. Meshsize larger in deeper choanosome, up to 350 \times 500 μ m, typically around 120-175 μ m. Common peripheral condensation, 300-350 μ m deep, of closely spaced secondaries and adventitious primaries, with mesh sizes mostly equal to greater fibre-diameters. Peripheral fibres commonly stratified, with 1-2 layers of granular

matter. Primary fibres cored by styles and subtylostyles, parallel, single or up to 4 abreast, with points out, occasionally askew, frequently broken. Secondary fibres mostly aspiculous. Thin strongyles scattered at random interstitially, frequent in periphery, scarce below. Some adventitious primaries in peripheral skeleton free, bud-like, encasing styles singly or in brushes, rarely protruding; more frequent at surface, mostly blunt or truncate, like tips of main primaries.

Spiculation: (1) Coring styles and subtylostyles, fusiform, thickest in the middle, length 38–45.8–52.9 μm , median/basal width 2.3–3.1/1.2–2.1 μm ; (2) interstitial strongyles, 124–146–178 \times 1–2.4 μm .

Remarks. The specimen contains many embryos, c. 175 μm in diameter. *Echinoclathria egena* belongs to the group of massive, ramose, and flabellate species without microscleres in Burton's key of *Ophlitaspongia* (1959: 247). The styles of *E. egena* are smaller than in any of those species. The lack of truly echinating spicules is also distinctive. Except for the interstitial strongyles, there is some resemblance to *Stylinos* (probably composite), particularly *Stylinos scariola* (Lamarck), which also has fusiform, subbasally constricted subtylostyles (fide Topsent, 1932a: 95).

Echinoclathria tubulosa (Hallmann)

Plate 6 figure 9, plate 25 figures 3, 4,
text-figure 45

Ophlitaspongia tubulosa Hallmann, 1912: 272, text-fig. 60, pl. 35 fig. 3 (SE coast).

Echinoclathria tubulosa. – de Laubenfels, 1936a: 119 (transfer only).

Material examined. Station KG 6, one specimen (F51979). Two syntypes of *Ophlitaspongia tubulosa* (AM).

Diagnosis. Short, stout tubes, conerescent basally and partly above. Single apical oscules. Vermilion to dull yellow-orange, firmly spongy, slimy in life. Surface smooth; thin dermis veiling regular punctiform vestibules. Internally cavernous. Fibre net irregular, lax. Primaries with hastate styles often

plumosely arranged. Secondaries aspiculous. Auxiliary styles irregularly scattered. No microscleres.

Description. Four stout tubes, conerescent basally and by pairs along contiguous sides. Width 6 > 3 cm, maximum height 5 cm. Individual tubes 1 cm wide, with apical oscules and atria 5–6 mm wide.

In life dull vermilion above (10 R – 2.5 YR7/10); dull yellow-orange below (2.5 Y9/10). Firmly spongy, slimy in life. Ostia now conspicuous, 0.1–1.5 mm wide, mostly collapsed into subdermal spaces. Surface microhispid. Atria terete, tapering near base. Choanosome cavernous, riddled by canals as wide as subdermal spaces.

Lax meshwork of spongin fibres irregular primaries 34–46 μm thick, often crooked, secondaries 16–44 μm thick, frequently branching and anastomosing. All fibres clear, some weakly stratified, crowded to distant. Principal megascleres styles, parallel, up to 4 abreast, or in plumose fashion in primaries, rarely protruding. Secondaries aspiculous. Auxiliary megascleres scattered irregularly, often concentrated in zones not related to fibre-meshwork, particularly crowded at surface. Microscleres absent.

Spiculation: (1) Principal styles, hastate, 102–115–132 \times 3.5–4.9–7 μm ; (2) auxiliary megascleres: mostly longer, slender hastate styles and styloids (anisostromyloxeae), intergrading, commonly straight, 111–208–296 \times 1.6–2.3–4.1 μm .

Remarks. The choanosome contains numerous scattered round bodies, in the shape of mulberries, 7–8 μm in diameter, presumably microsymbionts. They are deeply stained by basic fuchsin.

Desmacididae Schmidt, 1870

Synonym: Esperipsidae Hentschel, 1923.

Remarks. Van Soest (1984: 35) repeated Lévi's error (1973: 611) of using Esperipsidae Hentschel, 1923, and of disregarding the priority of Schmidt's family name. Both authors cited Desmacidonidae (pars) as synonym, and include *Desmacidon* in the family. As I have already stated (Wiedenmayer, 1977a: 79, footnote 4), Schmidt's original spelling (as Desmacidinae) has to be retained in accordance with ICZN Article 29bii (see also Appendix DVII, Greek entry no. 25, excluding nos. 32, 33), making Desmacidonidae and Desmacidontidae incorrect subsequent spellings. This provision does not affect the gender of *Desmacidon*, which was established as feminine by Bowerbank (1861), in accordance with ICZN Article 30d (30bii in previous editions, not 30ai2 as stated in my footnote). Though all names published in Bowerbank (1861, merely a list)

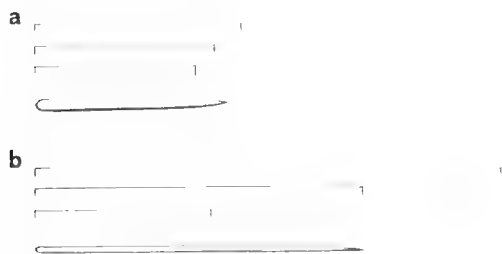


Figure 45. *Echinoclathria tubulosa*, spicules, $\times 197$. a. Principal styles. b. Auxiliary styles.

are nomina nuda, his intention therein is clear and consistent, all adjectival species names associated with *Desmacidon* and *Hymeniacidon* being feminine. Later, Bowerbank was still consistent in 1864, but inconsistent in 1863 and 1866 (feminine and masculine species names in both genera). If there are any lingering doubts as to proper fixation of the gender of these genera, reference should be made to the footnote in Thiele (1905: 421), which I had overlooked in 1977a. Though Thiele's etymological argument is open to doubt, his acceptance of the feminine gender is sufficient for the purpose of stability in nomenclature.

The family is here subdivided into two subfamilies. The nominotypical subfamily corresponds to the family as previously understood by Lévi (1973: 611f., part) and restricted by van Soest (1984: 48). The name Stylotellinae Lendenfeld is revived for a rather confused and controversial group of genera, of which, beside the type genus, the most important are *Phoriospongia* and *Psammoclema* (as redefined below). While *Stylotella* was recently included either in the Suberitidae or in the Hymeniacidonidae, *Phoriospongia* was included in the Myxillidae by Dendy (1924: 362), Topsent (1928: 54, as *Phoriospongiinae* Lendenfeld, 1889), and Burton (1934a: 552). *Phoriospongia*, *Psammascus*, *Psammoclema*, and their synonyms, were included by de Laubenfels (1936a: 96) in a new family Psammascidae, placing most emphasis, in the diagnosis, on the high content of sand in these sponges. The type genus *Psammascus* was misinterpreted by de Laubenfels, by ascribing to it proper megascleres and microscleres, and by merging in it *Phoriospongia*. The original definition of *Psammascus* and the description of its type species (*P. decipiens*, still alone in the genus) by Marshall (1880: 92f.) contained no mention of proper spicules. Vacelet, Vasseur and Lévi (1976: 63) followed de Laubenfels in erroneously placing *Phoriospongia lamella* Lendenfeld in *Psammascus*. The genus was still assigned to the Myxillidae by these authors, in agreement with Topsent and Burton. In the Stylotellinae sensu novo, the spiculation, as a rule, is scanty, if present, both in density and in weakness of individual spicules. The arrangement of megascleres, if present, is poorly organised and microscleres, if present, are commonly sigmata only. The exceptions are *Psammochela* and *Psammotoxa*, probable synonyms of *Phoriospongia*. The reticulate spicular skeleton, well developed and often rather complex microsclele complement, and the special ectosomal skeleton of the Tedaniidae (Myxillidae auctorum) are not or only exceptionally developed in the Stylotellinae.

The study of the new material of *Stylotella inaequalis* (Hentschel) (described below) has led to the

conclusions that *Batzella* is a junior synonym of *Stylotella*, and that *Stylotella* is related to *Phoriospongia*. Further considerations, arising from the study of our diverse material of *Phoriospongia* and *Psammoclema*, prompted the inclusion of this group in the Desmacididae. This view was confirmed at this time by van Soest's (1984: 47) placing of *Batzella* in the same family.

Apparent discrepancies and difficulties, in formulating a definition of the Stylotellinae, are resolved by regarding them as extreme differences of degree. Loss of spicules in sandy sponges is not uncommon, and also occurs in *Echinoclathria*. Absence of spongin (e.g. in *Stylotella* and in *Psammoclema densum*) versus a well developed reticulation of spongin fibres (e.g. *Phoriospongia guettardi* Topsent, 1933) are linked by intermediate stages. The spicular vicariance (ambivalence) of monactinal versus diactinal megascleres, in itself typical of the Desmacididae, is occasionally linked by intermediates within the same species, or even within one specimen (*Phoriospongia reticulum*, described above; *Stylotella inaequalis*, described below).

Of particular importance, in the definition of the Stylotellinae, is the dissociation, if both are present, of the skeleton formed by spongin and/or sand from the spicular skeleton.

Desmacidinae

Synonym: Esperipsidae sensu van Soest, 1984.

Diagnosis. "[Desmacididae] with a reticulate or plumo-reticulate choanosomal skeleton of monactinal or diactinal megascleres. Ectosomal skeleton absent (but organic dermis often strongly developed or charged with foreign material). Microscleres [if present] include palmate, anchorate or unguiferate isochelae and sometimes sigmata." (Van Soest, 1984: 35, for Esperipsidae.) Special types of microscleres (birotulates, plaochelae, bipocilli, canonochelae) occur in particular genera.

Strongylacidon Lendenfeld

Strongylacidon Lendenfeld, 1897b: 110. — Topsent, 1928: 45. — Burton, 1934a: 555 (diagnosis in Myxillidae, included species). — de Laubenfels, 1936a: 54 (in Desmacididae). — Lévi, 1973: 611 (definition in Esperipsidae). — Van Soest, 1984: 42 (definition in Esperipsidae), 46 (discussion).

Diagnosis. "[Desmacidinae] with plumosely arranged bundles of strongyles for megascleres and unguiferate or anchorate isochelae and [or] sigmata for microscleres." (van Soest, 1984: 42). Microscleres may be absent. Reticulate skeleton only in thickly encrusting, massive and branching specimens, plumose ascending columns with only basal anastomoses in thinly encrusting specimens.

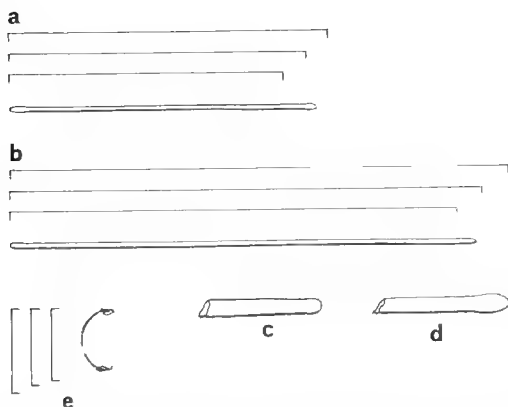


Figure 46. *Strongylacidon stelliderma*, spicules. a, b. Strongyles of two size ranges, $\times 322$. c, d. Enlarged ends, $\times 948$. e. chelae, $\times 948$.

Strongylacidon stelliderma (Carter)

Plate 6 figures 10, 11, plate 25 figures 5, 6
text-figure 46

Halichondria? stelliderma Carter, 1886h: 451 (Westernport Bay, Vic.).

Desmacidon stelliderma. — Dendy, 1896: 20 (holotype re-examined, new records from Port Phillip Heads). — Brøndsted, 1927: 3 (Port Chalmers, New Zealand).

Strongylacidon stelliderma. — Burton, 1934a: 554, 555 (transfer and synonymy only).

Burtonispongia stellidermu. — de Laubenfels, 1936a: 53 (transfer to gen. nov. only).

Desmacidon plicatum Hentschel, 1911: 321, text-fig. 18 (WA).

Material examined. Station BSS 181, one specimen (F51981). Holotype, BMNH 1886.12.15.148, wet, from Westernport Bay, ex J.B. Wilson collection.

Diagnosis. Small, massive-lobate, or irregularly compressed, frondose to ramose, with encrusting base. Spongy to limp, easily torn. Surface regularly conulose to lacinulate, with axial spicular column. Oscules scarce, irregularly scattered, apical in massive-lobate specimens. Irregular, angular net of compact to disheveled fibres packed with strongyles, which are also scattered interstitially. Structure denser, lacy or festooned below surface. Frail chelae numerous throughout.

Description. Attached to chaetopterid worm tube. Base encrusting, about 1 mm thick, bearing few short irregular fronds and branches. Thinner branches angular, with polygonal cross-section, larger ones much compressed, almost paper-thin. Colour in life not noted, now off-white. Limp, easily torn. Surface finely conulose, long conule tips often recurved and ending in whiplike extension of primary spicular fibre. Density of conules variable, highest on edges of branches. Oscules

scarce, irregularly scattered in depressions. Ostia inconspicuous, in rows along fine meandering and dendritic subdermal canals.

Skeletal structure (pl. 25 figs 5, 6) irregular reticulation of fibres filled with megascleres; these also scattered interstitially in choanosome and dermis. Reticulation irregular in orientation and thickness of fibres (35–150 μm), and in extremely variable shape and size of meshes. Individual fibres straight, angular or sinuous; compactness varies, some break up, intergrading with surrounding interstitial megascleres. Clear spongin barely visible in more compact fibres. Thicker fibres usually more continuous. Short ones (anastomoses) frequently expand at junctions. Dermal skeleton of thinner spiculo-fibres; arrangement lacy, vaguely umbellar, or, most frequently, festoon-like (closely spaced parallel fibres arching inwards between principal fibres forming axes of conules).

Dermis 350–430 μm thick, dense, light brown in sections, with granular collagen, few interstitial megascleres. Choanosome distinctly lighter, less collagenous, riddled by incurrent canals, around 50 μm wide. Excurrent canals around 120 μm wide, commonly surrounded by denser matrix with apochetes and some megascleres both radial. Small, frail chelae numerous everywhere, crowded in linings of most canals.

Spiculation: (1) Strongyles, often with one or both ends slightly swollen to subtylote, of two size ranges: (a) 108–117–126 \times 0.8–1.6–2.2 μm and (b) 176–185–197 \times 1.2–1.9–2.5 μm ; both sizes occur interstitially, distinction in fibres not determined. (2) Frail unguiferous anchorate chelae, C-shaped, teeth atrophied, little recurved if at all, chord 9.4–10–11.1 μm , depth 3.4–3.9–4.4 μm .

Remarks. The holotype of this species (pl. 6 fig. 11) is massive, bulbous, with conspicuous apical oscules. The conules are blunt in the apical region, but pointed below, with tips of spiculo-fibres regularly protruding. Ostia, distinctly visible at low magnification, are regularly scattered in depressions between conules. *Strongylacidon sansibarensis* Lendenfeld (1897b, the type species) is little known. It was described as thickly encrusting, finely conulose, permeated by a dendritic alga, and possessing, as only microscleres, unguiferous anisochelae 6.7–9 μm long, and strongyles measuring 160–260 \times 3–4 μm . *Strongylacidon intermedia* Burton (1934a) and *S. frutex* (Pulitzer-Finali, 1982b), from the Great Barrier Reef, both lack microscleres (see below, Remarks on *Stylotella*). The genus is well represented in the West Indian region (van Soest, 1984: 42f., with descriptions of three new species, all thinly incrusting, and discussion of other species, some as species inquirendae).

Stylotellinae Lendenfeld, 1888, sensu novo

Synonym: Phoriospongiinae Lendenfeld, 1889.

Diagnosis. Desmacididae with reduced spiculation. Megascleres monactines or diactines or both, with intraspecific and individual transitions. Microscleres, if present, usually sigmata only, but chelae, toxa, microtylotes and raphides may occur. Microscleres or the whole spiculation may be lost, in some species always, in others in some specimens. Spongin skeleton, when present, reticulate or dendritic. All spicules usually interstitial except in type genus, where spicules also occur in whispy, vaguely plumose but not reticulate fibres. Most species incorporate much foreign detritus, commonly aggregated or encased by spongin, and/or scattered to packed interstitially. Commonly a cortex packed with debris, but missing in some species or individuals. Cortical concentration of erect or felt proper megascleres may occur.

Stylotella Lendenfeld

Stylotella Lendenfeld, 1888: 185. — Hallmann, 1914b: 348 (discussion, revision: to Suberitidae). — Burton, 1934b: 41 (discussion, synonymised with *Hymeniacidon*). — de Laubenfels, 1936a: 152 (definition in Suberitidae). — Bergquist, 1968: 24 (in Suberitidae). — Pulitzer-Finali, 1978: 72 (in Hymeniacidonidae, Mediterranean records excluded).

nec *Stylotella* (as applied to European records) sensu Topsent, 1925a: 637f. (Mediterranean). — Vacelet, 1960: 264 (Mediterranean). — Borojević, Cabioch and Lévi, 1968: 17 (English Channel). — Boury-Esnault, 1971: 327f. (Mediterranean with further references).

Batzella Topsent, 1894b: xxxiv (English Channel). — Thiele, 1905: 438 (discussion, not the two species included). — Burton, 1934a: 554f. (discussion: monotypic; definition in Myxillidae). — de Laubenfels, 1936a: 138 (definition in Hymeniacidonidae). — Pulitzer-Finali, 1978: 68 (part: not *Batzella friabilis*). — Pulitzer-Finali, 1982b: 98 (in Halichondriidae: part; not *B. frutex*, not *B. intermedia*). — Van Soest, 1984: 47 (definition in Esperipsidae, discussion).

Collosclerophora Dendy, 1917: 320. — Dendy, 1922: 74 (discussion). — de Laubenfels, 1936a: 53 (definition in Desmacididae).

Diagnosis. "[Stylotellinae] with a reduced, loosely plumose skeleton of strongyles (tornotes); no ectosomal skeleton; no microscleres." (Definition of *Batzella* [in Esperipsidae] in van Soest, 1984: 47).

Remarks. *Batzella friabilis* and *B. frutex* Pulitzer-Finali possess a reticulate skeleton, and so does *Strongylacidon intermedia* Burton (1934a), which was transferred to *Batzella* by Pulitzer-Finali (1982b). These species are best included in *Strongylacidon*, despite the lack of chelae. This is consistent with van Soest's recent revision of West Indian Poecilosclerida, particularly with regard to

loss of chelae (1984: 7, table 1,b) and his greater emphasis on skeletal structure.

Stylotella inaequalis (Hentschel)

Plate 7 figures 1, 2, plate 26 figures 1-4,

text-figure 47

Batzella inaequalis Hentschel, 1911: 325, text-fig. 20 (Shark Bay, Denham, Albany, WA). — Pulitzer-Finali, 1982b: 98 (in discussion).

nec *Strongylacidon inaequalis*. — Burton, 1934a: 550 (Great Barrier Reef). — Burton, 1959: 242 (Arabian coast).

nec *Cacochalina truncatella* var. *mollissima* Lendenfeld, 1887a: 763 (cited as synonym of *Strongylacidon inaequalis* by Burton, 1927a: 292, and 1959: 242).

Collosclerophora arenacea Dendy, 1917: 321, pl. 11 (Port Phillip Heads, Vic.). — Dendy, 1921: 133, text-fig. 49 (discussion). — Dendy, 1922: 74, 76 (discussion).

Material examined. Station BSS 181, seven specimens (F51982 through F51988).

Diagnosis. Small, variably encrusting, irregularly lobulate, or with short, crooked, frilly branches more or less concrescent. Frequently attached to or enveloping tall objects (worm tubes, algae). Limp to rubbery. Brownish orange in life. Surface smooth, semi-diaphanous, occasionally finely verrucose. Oscules small, round or slit-shaped. Spicules partly scattered, partly in loose, often indistinct, whispy fibres of variable thickness and spacing. Peripheral umbels and felt of spicules may occur. Spongin scanty. Variable amounts of sand and scattered foreign spicule debris internally and at surface. Macro- and microsymbionts common. Spicules variably strongyles or styles/subtylostyles, often combined.

Description. Six specimens small, around 1 cm in greatest dimension, attached to chaetopterid worm tubes or to algae, together with other sponges. Thinly or thickly encrusting; or irregular, with concrescent lobes separated by thin invagination; also with angular or compressed, crooked and folded branches, some crowded, others free. Seventh specimen (F51988, pl. 7 fig. 2) up to 4.5 cm high, a group of compressed, frilly and aculeate branches from basal disc and pedicel, largely pseudomorphic, from growing around agal branches. Compressible, limp in branches, firmer, rubbery in lobes and thick encrustations. In life brownish

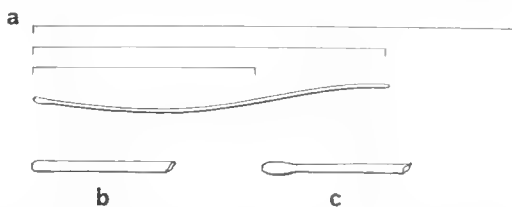


Figure 47. *Stylotella inaequalis*, spicules. a. Strongyles (subtylostongyles), $\times 394$. b, c. Enlarged ends, $\times 1169$.

orange (5 YR5/12 in F51987, 7.5 YR5/8 in F51988); beige to cream in alcohol. Surface generally smooth in small specimens, with narrow, den-

dritic and anastomosing subdermal canals; finely, irregularly conulose in larger specimen. Surface partly microhispid with protruding spicules. Some

Table 2. Skeletal features and symbionts in *Stylotella inaequalis*

Specimen	Skeletal structure*	Dominant spicule types	Spicular dimensions (μm)	Foreign debris	Symbionts
F51982	2 + 5 (periphery); 4 (centre)	Strongyles	141.0–155–161 \times 1–1.3	Few sand grains	Macro
F51983	2 (periphery); 4 (centre)	Subtylostyles	231–248–262 \times 2.4–2.9–3.6	Much coarse sand in vaguely dendritic columns	
F51984	2 + 4 (periphery); 4 (centre)	Strongyles and subtylostrongyles	154–161–168 \times 0.9–1.3–1.5	Few sand grains	Macro and micro (mulberry type, 235–275 μm , wide, scattered)
F51985	1 + 5	Strongyles, fusiform, slightly subtylote	193–207–219 \times 1.8–2.3–2.7	Few sand grains	Micro, crowded (clusters of 2–5 cysts, total diameter 16 \times 12 μm)
F51986	3 + 6	Styles and subtylostyles, fusiform	121–182–249 \times 1.3 1.9–2.7	Spicule fragments concentrated at surface. Few sand grains	Macro
F51987	3 + 6 + 7	Styles and subtylostyles, fusiform	172–210–238 \times 2–2.5–3.2	Spicule fragments concentrated at surface. Few sand grains	Macro
F51988	2 + 5 + 8 (periphery); 5 (centre)	Subtylostyles, fusiform	158–186–201 \times 1.6–2.0–2.3	Frequent sand grains and spicule fragments scattered and clustered	Macro

*1. Fibres of variable thickness, widely spaced, dendritic, gently curved.

2. Fibres closely spaced, thin, wispy.

3. Fibres thicker, closely spaced, very sinuous and angular.

4. Interstitial spicules scarce.

5. Interstitial spicules abundant, frequently transverse, single or in bundles.

6. Interstitial spicules crowded.

7. Conspicuous peripheral umbels and felted arrangement at the surface.

8. Spongion present in some fibres.

sand grains, particularly in F51983. Oscules small, round and clustered, or slit-shaped. In some specimens, regular round subdermal spaces covered by sieve-like membrane. In other specimens, including largest one, fine reticulation of dermal membrane conspicuous, with ostia in meshes, accentuated by concentration of foreign spicule debris in dermis of two specimens. Dense, finely collagenous choanosome, brownish in transmitted light. Dermis lighter, 15–25 μm thick. Skeletal structure variable (pl. 26 figs 1–4, and table 2). Types in table 2 approximate, transitions within and among specimens common. In type 2, wispy fibres may become angular, with spicules frequently broken. Most common macrosymbionts, frequently concrescent tubes, 140–300 μm in diameter. Pale, clear spongin only in some fibres of largest specimen.

Spiculation: Polarity between diactinal and monoactinal spicules. Intermediate forms (subtylostrogyles, styloids with the thinner end blunt or mucronate) with dominant subtylotes, never frequent. Subtylote condition faint, thickest in fusiform shaft; slight subterminal constrictions abrupt inside elongate heads. Spicules may be mostly straight (in F51988), otherwise majority curved, bent or flexuous in variable degrees. Blackened axial canals frequent. Dimensions 121–192–262 \times 0.9–1.9–3.6 μm .

Remarks. Burton (1934a, 1959) misinterpreted Hentschel's description. The sponges misidentified by him have a coarsely conulose surface and a reticulate skeleton regularly reinforced by spongin. They should probably be left in *Strongylacidon*. *Cacochalina truncatella mollissima* Lendenfeld likewise has a reticulate skeleton.

Hentschel's description agrees with the present material, particularly the modes of growth and attachment, the smooth surface, the semi-diaphanous dermis, the skeleton consisting partly of scattered spicules, partly of very loose spicular tracts of variable spacing, frequently merging when crowded. Though six of the present specimens have weaker and shorter spicules, Hentschel's measurements agree with those of F51983.

The "colloscleres" in *Collosclerophora arenacea* are here interpreted as foreign, probably microsymbionts, though of a kind not seen in the present material. Globular and cystose microsymbionts, however, are commonly found in sandy *Stylotellinae*, and there does not appear to be an obligatory/specific relationship. Dendy (1922: 74) found similar, though not identical "colloscleres" in *Colloclathria ramosa*. The genus is not related to *Stylotella*, and was merged in *Rhaphidophylus* (correctly *Thalysias*) by van Soest (1984: 109).

There are obvious similarities between *Stylotella inaequalis* and *Stylotella agminata*, particularly as redescribed by Hallmann (1914b: 349; pl. 21 figs 1–5, pl. 22 fig. 2; erroneously cited in description). These concern growth form and skeletal structure and their range of variability. However, inclusions of foreign detritus were not described in *Stylotella agminata* and its synonyms. Tangential arrangement of dermal spicules, not exclusively developed in *S. inaequalis*, only occasionally seen as a component of a felted arrangement in one of our specimens, seems to be the rule in *S. agminata*. The chief distinction resides in the spicules: those in *S. agminata* are always styles and subtylostyles, the latter with heads slightly thicker than the hastate shaft. Their dimensions exceed those in *S. inaequalis* slightly in length, distinctly in thickness.

Stylotella inaequalis links the hitherto misplaced genus with *Phoriospongia* and *Psammoclema* in several features: (1) the presence of foreign detritus, with a tendency to segregation of sand grains and spicule fragments, with concentration at the surface and occasional arrangement in columns or lamellae inside, but without specific or intraspecific consistency; (2) the generally loose arrangement of spicules with little order except ascending tracts, never truly reticulate; (3) the common weakness of megascleres; (4) the inconsistent spicular vicariance of diactinal versus monoactinal megascleres, with little morphological differentiation within specimens; (5) frequency of variably bent megascleres. These traits also advise against affinities with either the Suberitidae, Halichondriida, Mycalidae, and Tedaniidae.

Phoriospongia Marshall

Phoriospongia Marshall, 1880: 122. —George and Wilson, 1919: 155 (synonymised with *Chondropsis*). —Dendy, 1924: 362 (definition, discussion, synonymised with *Chondropsis*). —Topsent, 1928: 54 (synonymised with *Chondropsis*, *Psammochela*). —Topsent, 1933: 50 (footnote 1, résumé, synonymised with *Chondropsis*). —de Laubenfels, 1936a: 96, 99 (synonymised with *Psammascus*).

Holopsamma Carter, 1885b: 211 (part). —nec sensu Loeblich and Tappan, 1964: C792 (under Xenophyphorida, wrong type species).

Chondropsis Carter, 1886a: 45. —Dendy, 1895: 500 (discussion). —de Laubenfels, 1936a: 99 (synonymised with *Holopsamma*).

Sigmatella Lendenfeld, 1888: 195. —de Laubenfels, 1936a: 97, 99 (synonymised with *Holopsamma*).

Psammochela Dendy, 1916b: 126. —George and Wilson, 1919: 155 (synonymised with *Phoriospongia*). —Dendy, 1924: 362 (retained). —Burton and Rao, 1932: 334 (revision). —de Laubenfels, 1936a: 99 (definition in *Psammascidae*).

Psammotoxa de Laubenfels, 1936a: 99.

Diagnosis. Sandy Stylotellinae, variable in amount and distribution of foreign detritus, in spiculation and in development of reticulate or dendritic spongin fibres. Megascleres mostly frail strongyles, subtylostongyles, subtylostyles, styles and subtylotes with frequent transitions, scattered or in vaguely radial to plumose arrangement. Microscleres, if present, either sigmata, chelae, or toxa. Spiculation may be reduced to rare megascleres. Cortical reinforcement by spicules or debris frequent.

Phoriospongia argentea (Marshall)

Plate 7 figures 3–7, plate 26 figure 5,
plate 38 figure 6, text-figure 48

Dysidea argentea Marshall, 1880: 107, pl. 7 figs 6–11 (Australia, probably Bass Strait).

Chondropsis arenifera Carter, 1886a: 45 (as *Chondopsis*, lapsus, Port Phillip Heads, Vic.).—Carter, 1886b: 122.—Dendy, 1895: 255.

Material examined. Station KG 6, one specimen (F51989). Holotype of *Dysidea argentea* (PMJ). Syntypes of *Chondropsis arenifera* (BMNH).

Diagnosis. Cushion-shaped or massive, bulbous or lobate. Firm, moderately compressible. Cream to light beige in life. Surface smooth, glabrous, to vaguely rugose and verrucose. Oscules conspicuous, rounded-polygonal, often slightly recessed. Regularly armoured ectosome 0.3–0.5 mm thick, finer detritus on surface, coarser grains deeper. Choanosome fleshy, with radial-meandering tracts of debris and canals in periphery. Macro- and microsymbionts common. Debris in tracts often coarser than interstitially. Proper spicules weak flexuous strongyles, mostly radially arranged.

Description. Asymmetrically cushion-shaped, sinuous margin, 4.5 by 2.5 cm wide, 0.5 cm to 1 cm high. Margin with fine branching algae and hydroids. In life and in alcohol cream to light beige, fine greenish specks in life. Firm, moderately compressible.

Surface smooth, almost glabrous in life, rugose in alcohol. One oscule, 2 mm wide, with a rounded-triangular recessed margin.

Fine, indistinct regular ostia. Armoured ectosome 320–500 μ m thick. Choanosome fleshy, firm,



Figure 48. *Phoriospongia argentea*, spicules. a. Strongyles, $\times 392$. b. Enlarged end, $\times 1165$.

with debris in tracts wavy to meandering in periphery. Regular perpendicular canals also wavy in portions of periphery, as in one of syntypes (pl. 7 fig. 6). No cyanophycean algae as recorded by Carter and Dendy; but regularly distributed small tallophyte algae, sac-shaped, stuck in and just below surface (greenish specks in life).

Debris tend to sorting by size and nature: in choanosome, larger fragments, chiefly lithic, arranged in meandering tracts; finer detritus, chiefly spicule fragments, strewn interstitially. In ectosome, coarser lithic fragments pack inner, thicker portion; finer material, chiefly spicule fragments and spicules of didemnid tunicates, fill thinner surface layer. Proper spicules mostly arranged radially, few scattered randomly. Some crowded in vague ascending tracts, occasionally in plumose fashion.

Spiculation: weak strongyles, frequently flexuous, 101–129–156 \times 1–1.3 μ m.

Remarks. The new specimen being small and not very typical, the holotype of *Dysidea argentea* and two syntypes of *Chondropsis arenifera* are figured for comparison. Salient features are the tuberoso shape, mostly smooth, glabrous surface, firm, fleshy choanosome, and slightly recessed oscules of irregular outline. Marshall did not mention proper spicules, but admitted to having examined his specimen in a cursory way. Still, it is not unlikely that proper spicules may be absent in some specimens. For comparison with similar congeners, see Remarks on *Phoriospongia kirki*, below.

Phoriospongia carcinophila (Lendenfeld)

Plate 7 figures 8, 9, plate 26 figure 6,
plate 27 figures 1, 2, text-figure 49

Sigmatella carcinophila Lendenfeld, 1889a: 66 (in key).—Lendenfeld, 1889b: 615, pl. 41 fig. 8 (Port Jackson, NSW).

Chondropsis carcinophila.—Burton, 1934a: 552 (Great Barrier Reef).

Material examined. Station BSS 179, one specimen (F51990); station BSS 181, two specimens (F51991, F51992). Type specimens of *Sigmatella carcinophila* (AM and BMNH).

Diagnosis. Contorted-lobate, often small, frequently attached to shells or crabs. Spongy, soft to moderately firm, easily torn. Dull orange brown



Figure 49. *Phoriospongia carcinophila*, spicules (strongyles), from F51990, $\times 306$.

to purplish brown in life. Surface finely rugo-vermiculate to verrucose. Oscules of 2 sizes not above 2 mm wide. Detritus in ectosome and choanosome ill sorted, variably dense, in meandering tracts below ectosome. Proper spicules variably frequent, scattered in and around tracts of debris, and parallel to plumose in short ascending tracts below ectosome. They may be concentrated in ectosome, vaguely umbellar to confused.

Description. F51990 (pl. 7 fig. 8) elongate, irregularly lobose, somewhat compressed, 8 cm long, 2.5–3 cm high, 1–2 cm wide. Partly overgrows two *Pecten* shells and supports delicate branching algae, hydroids and bryozoans, some incorporated. F51991 (pl. 7 fig. 9) one-half of contorted-lobose specimen growing on crab's back, $2 \times 2 \times 1$ cm. F51992 compressed, rounded, margin and upper sides with crowded, stubby lobules mostly compressed in same plane; $2 \times 2.5 \times 1$ –2 cm. Smaller specimens in life dull orange-brown; surface 5 YR 6/6 for F51991, 10 YR 6/4 for F51992; choanosome 5 YR5/10 for F51991. Spongy, soft to moderately firm.

Surface smooth, finely wrinkled (in alcohol); microscopically finely conulose to tuberculate, tips 200–400 μ m apart, frequently connected by slight ridges. Fine ostia regularly crowded, more conspicuous in slightly depressed interstices. Oscules of two kinds: small circular ones, about 200 μ m wide, frequent; larger ones up to 1.5 mm wide, infrequent, circular or elongate, irregular in outline.

Armoured ectosome around 100 μ m thick, chiefly of spicule fragments, with fine lithic detritus interspersed. Choanosome dense, brown in transmitted light, granular and fibrillate. Detritus in choanosome coarser than at surface, ill-sorted, of foreign spicules, their fragments, lithic grains in about equal proportions; mostly in meandering, chiefly ascending tracts, without visible spongin, often in fascicles at variable intervals, with few indistinct anastomoses and branches. No coincidence with tubercles at surface. Tracts more irregular, angular, and tighter in F51992. Proper spicules (more abundant in F51991) in deeper choanosome concentrated in and around tracts of debris. Few short tracts of subparallel spicules interstitially, more frequent in peripheral choanosome. F51990 somewhat different from other specimens. Purplish brown (5 R 3/3 to 7.5 R 3/4) in life, yellow-grey in alcohol (5 Y 6/4). Softer, more easily torn than smaller specimens. Relief at surface, reticulation of ridges, more pronounced and coarser. Ostia inconspicuous. Small oscules in interstitial depressions frequent, larger oscules (around 2 mm wide) conspicuous.

Detritus in ectosome coarser than in smaller specimens, almost entirely lithic fragments, frequently scattered. Detritus in choanosome scanty, foreign spicules rare. Fragments in tracts frequently encased by spongin. Proper spicules abundant; in choanosome, interstitially and within fibres, mostly at random. Some fibres or their portions almost free of detritus, but always with proper spicules. Proper spicules particularly abundant in peripheral choanosome and at surface. In periphery frequently in closely spaced subparallel to plumose tracts. In ectosome, arrangement vaguely umbellar to confused, almost felted.

Spiculation: strongyles, straight, or bent and flexuous to variable degree in all three specimens; strongest in F51990, weakest in F51992. Dimensions for F51990, 151–186–208 \times 1.3–2.3–3.1 μ m; F51991, 156–167–176 \times 1–1.6–2.2 μ m.

Remarks. This species is most similar to *Psammoclema densum* (described below) in external shape, mode of attachment, surface, consistency and colour. *Phoriospongia carcinophila* is commonly firmer, has a better organised ectosome and peripheral choanosome, including proper spicules in ascending tracts, which are always lacking in *P. densum*. See also Remarks on *Phoriospongia kirki*, below.

Phoriospongia kirki (Bowerbank)

Plate 7 figures 10–12, text-figure 50

Dysidea Kirkii Bowerbank, 1841c: 161 (Wollongong, NSW).—Bowerbank, 1844b: 68, pl. 6 fig. 9.—Bowerbank, 1864: 212.—Carter, 1881a: 374 (South Coast).—Carter, 1885b: 216 (Port Phillip Heads, Vic.).—Lendenfeld, 1885a: 23.

?*Spongelia Kirkii*.—Hyatt, 1877: 539, pl. 17 fig. 19 (Phillip Island, Vic.).

Chondropsis kirkii.—Dendy, 1895: 251 (Port Phillip Heads and Sorrento Jetty, Vic.).—Whitelegge, 1901: 77 (Tuggerah Beach, NSW).—Whitelegge, 1906: 465 (off Wollongong, off Narrabine, NSW).—Dendy, 1916b: 127 (Okha/Beyt, Kathiawar Peninsula, India).—Dendy, 1924: 363 (Spirits Bay, North Cape, New Zealand).—Shaw, 1927a: 433 (Maria Island, Tasmania).—Burton, 1938: 20 (Maria Island, Tasmania).

Psammascus kirkii.—de Laubenfels, 1936a: 99 (transfer only).

Dysidea favosa Marshall, 1880: 98, pl. 6 figs. 6–11 (Bass Strait).—Ridley, 1884a: 388 (Darwin, NT).



Figure 50. *Phoriospongia kirki*, spicules (strongyles), from F51993, \times 366.

?*Halichondria mammillata* Lendenfeld, 1888: 81 (part, Port Jackson).—Whitelegge, 1902b: 277, 282 (revision).—Hallman, 1914b: 340 (revision).

Sigmatella australis var. *tubaria* Lendenfeld, 1888: 197 (Port Jackson).—Lendenfeld, 1889b: 613, pl. 40 fig. 4, pl. 42 figs 4, 5.—Whitelegge, 1889: 185 (Shark Reef, Port Jackson).—Guiler, 1950: 10 (Blackmans Bay, Tasmania).

Sigmatella australis var. *flabellum* Lendenfeld, 1888: 198 (Port Phillip Bay, Vic.; Port Jackson).—Lendenfeld, 1889b: 614, pl. 41 figs 6, 9, 10, 11.—Whitelegge, 1889: 185 (off Green Point, Port Jackson).

Sigmatella corticata Lendenfeld, 1888: 199 (collective name, no nomenclotypical subspecies).—Whitelegge, 1889: 185 (off Shark Point, Port Jackson).—Guiler, 1950 (D'Entrecasteaux Channel and Blackmans Bay, Tasmania).

Sigmatella corticata var. *mammillaris* Lendenfeld, 1888: 199.—Lendenfeld, 1889b: 622, pl. 40 fig. 5, pl. 41 fig. 4 (Port Phillip Bay, Vic.).

Sigmatella corticata var. *papillosa* Lendenfeld, 1888: 201 (St Vincent Gulf, SA; Tas.; Port Phillip Bay and Westernport Bay, Vic.; Port Jackson, NSW).—Lendenfeld, 1889b: 620, pl. 40 fig. 2 (part, type series composite).—Whitelegge, 1889: 185 (Maroubra Bay, NSW).

Sigmatella corticata var. *flabellum* Lendenfeld, 1888: 203 (Port Phillip Heads and Bay, Vic.; Port Jackson, NSW).—Lendenfeld, 1889b: 624, pl. 40 figs 6, 8.—Whitelegge, 1889: 185 (off Green Point, Port Jackson).

Sigmatella corticata var. *serrata* Lendenfeld, 1888: 203 (Port Phillip Bay, Vic.; Port Jackson, NSW).—Lendenfeld, 1889b: 625.

Material examined. Station KG 6, one specimen (F51993); station BSS 187, two specimens (F51994, F51995). Type specimens of *Dysidea kirki* (BMNH). Holotype of *Dysidea favosa* (PMJ). Type specimens of *Halichondria mammillata*, *Sigmatella australis* var. *tubaria* and *flabellum*, *S. corticata* var. *mammillaris*, *papillosa*, *flabellum* and *serrata* (AM and BMNH). Hypotypes of *Dysidea kirki*: Carter, 1885b (BMNH) and of *Chondropsis kirki*: Dendy, 1895 (NMV).

Diagnosis. Massive, lobate, mammillate, tubular, or irregularly and thickly lamellate to flabellate, with entire or serrated margin, occasionally concrescent-ramose, with compressed branches. Firm, sandy, compressible to rigid, mostly easily broken, crumbly, slimy. Abundance of sand and average grain size variable. Dull yellow to pale orange or yellowish brown in life. Surface regularly rugo-reticulate, alveolate, with meshes around 1 mm, partitions 0.5 mm wide. Pattern sometimes finer, may be veiled by thin armoured ectosome. Oscules conspicuous, apical on lobes, marginal on lamellae, with surrounding surface denser, smooth. Choanosome cavernous, skeleton alveolate, with contorted, compressed trabeculae packed with sand, with little spongin. Proper spicules scattered interstitially in variable amounts of matrix; thin strongyles and small sigmata; the latter may be

scarce or absent, strongyles occasionally also rare or wanting.

Description. F51993 (pl. 7 fig. 12) with rounded lobes and apical oscules like var. *mammillaris* of Lendenfeld. F51994 and F51995 like var. *flabellum* Lendenfeld, the former a single thick lamella, somewhat convoluted, with wide, truncate to slightly convex margin; the latter composite, with two lateral, partly concrescent lamellae perpendicular to main lamella. F51993 and F51995 yellowish brown in life; F51994 yellow to pale orange. Firm, crumbly as in stale bread, slightly compressible to rigid, conspicuously sandy and slimy. Surface thrown into polygonal meshwork of ridges and depressions. Meshes around 1 mm wide, commonly elongated radially on sides of flabellate specimens. Ridges about 0.5 mm wide. Areas around base in F51993, and around oscules in all specimens, smooth, covered with armoured ectosome.

Oscules up to 6 mm wide, round, with sharp skeletal margin, and iris-like membrane. Commonly smaller, crowded on truncate margins of lamellae, 3 to 4 across.

Choanosomal skeleton consists of (1) curved compressed trabeculae packed with sand, around polygonal alveoles, similar in size to meshwork at surface; (2) interstitially scattered proper spicules. Meshwork interrupted and frequently indistinct, by irregular exhalant canals of variable diameters, intergrading with alveoles. This pattern again interrupted, in mesial and distal portions of flabellate specimens (and in axes of lobes of mammillate specimens), by regular, terete to slightly tapering atria (see Lendenfeld, 1889b, pl. 40 fig. 6).

Spiculation: strongyles only in F51993 and F51994; no proper spicules in F51995. Strongyles mostly bent to flexuous, 129–154–172 × 0.8–1 µm in F51993, 134–168–191 × 1–1.1 µm in F51994.

Remarks. The species is very polymorphous, more so than admitted by Lendenfeld and Dendy. This is demonstrated by the many type specimens and hypotypes examined. Lendenfeld's varietal names cover the range of external shapes only inadequately, and several specimens seen by me are either intermediates or combine traits of two or more of his varieties. An extreme phenotype, not covered in Lendenfeld's descriptions, is represented by one of Bowerbank's specimens with compressed branches partly fused in a coarse clathrate arrangement.

There is no congruence between shape, colour, consistency, skeletal structure, and surface characters. Consistency varies between rigid and quite compressible, as a function of relative abundance of sand (of variable average grain size), spongin,

and fleshy matrix. Most of Dendy's hypotypes in Melbourne (all wet) are compressible, with a fleshy choanosome, and a distinct, continuous ectosome, in which the sandy armour is reticulate, in petaloid fashion with clustered ostia in the slightly recessed membranous interstices. This condition corresponds to that illustrated by Lendenfeld (1889b, pl. 42 figs 4, 5) for *Sigmatella australis*.

The holotype of *Dysidea favosa* (pl. 7 fig. 11) is of the "australis-type" in external shape, has exceptionally pliable and regularly reticulate fibres, no trace of an ectosome, and a very scanty matrix (but may have been partly macerated when collected).

Dendy (1895) remarked on the absence of sigmata in some of his specimens. It is here surmised that in specimens like the new ones, with much coarse sand, also megascleres may be virtually or completely suppressed, in analogy to *Echinoclathria laminaefavosa* and *E. globosa* (see above).

Of the other common, better known species of *Phoriospongia* in southern Australia, which are chiefly massive to lobate, with finely uniform surface, *P. argentea* is consistently tuberoso or cushion-shaped, fleshier, its surface always smooth, with thicker ectosome, choanosome dense, foreign debris not in reticulate/alveolar disposition. *P. carcinophila* is generally softer, also lacks the reticulate arrangement of debris, being the least organised of the three species in this respect. Both *P. argentea* and *P. carcinophila* do not possess sigmata. See also Remarks on *P. carcinophila*, above.

Yet another congener close to *P. kirki* is *P. lamella* Lendenfeld (1888). Though it may also be irregularly massive, it is commonly thickly erect-lamellate. It differs from *P. kirki* by its lighter colour (light grey, almost white), its straight, more robust strongyles (2–3 μ m thick), and by having two sizes of sigmata. It has been recorded again from New South Wales by Whitelegge (1906: 465), from Port Phillip Heads by Dendy (1895: 253), and from the reef complex of Tulear (Madagascar) by Vacelet et al. (1976: 63).

Psammoclema Marshall

?*Psammascus* Marshall, 1880: 92.—nec sensu de Laubenfels, 1936a: 96.—nec sensu Vacelet, Vasseur and Lévi, 1976: 63.

Psammoclema Marshall, 1880: 109.—Lendenfeld, 1889b: 124 (as synonym of *Chalinopsilla*).—de Laubenfels, 1936a: 59 (as synonym of *Dactylia*).

Psammopemma Marshall, 1880: 113.—Dendy, 1905: 210 (definition).—de Laubenfels, 1936a: 96 (discussion), 99 (definition in *Psammascidae*).—nec sensu Loeblich and Tappan, 1964: C794 (under *Xenophyophorida*).

Holopsamma Carter, 1885b: 211 (part).—nec sensu

Loeblich and Tappan, 1964: C792 (under *Xenophyophorida*, wrong type species).

Sarcocornea Carter, 1885b: 214.—de Laubenfels, 1936a: 30 (as synonym of *Dysidea*).—Bergquist, 1980b: 480 (as synonym of *Dysidea*).

Diagnosis. Stylotellinae without proper spicules. Foreign debris commonly abundant in choanosome and ectosome. Distinct from *Phoriospongia* only by the consistent absence of proper spicules.

Remarks. Marshall distinguished *Psammoclema* and *Psammopemma* on the grounds of differences in shape (ramose versus massive), surface (detachable ectosome/no ectosome), aquiferous system (conspicuous, geometrical/lipostomous and "lipogastric"), and skeletal structure (dendritic fibres/amorphously packed sand). Most of the species here included in *Psammoclema* would be impossible to distribute among two genera using Marshall's criteria, and introduction of new genera in this heterogeneous group is undesirable. *Sarcocornea nodosa* Carter, the type species, with its heavily armoured ectosome, lack of discrete fibres, and dense choanosome, clearly does not fit into *Dysidea* and falls easily within this group.

Psammascus could be regarded as a senior synonym (by page priority) on the basis of the original description. The misinterpretation by de Laubenfels and by Vacelet et al. has already been noted above (Remarks on *Desmacididae*). According to Marshall's description, the monotypic genus is distinct by its tubular shape, by its discrete fibre net (anastomosing, regularly ascending primaries) charged with foreign debris, by soft, limp consistency, and by absence of proper spicules. Tubular shape is not uncommon in *Phoriospongia* [*P. confederata* (Lamarck), *P. syringiana* (Whitelegge)], and is thus compatible with *Psammoclema* sensu novo. On the other hand, *Psammascus decipiens* might be a *Dysidea*. The holotype seems to be lost (I could not find it among Marshall's material of 1880 in PMJ and ZMB). *Psammascus* is therefore best treated as a nomen dubium.

Psammoclema bitextum sp. nov.

Plate 7 figure 13, plate 27 figure 3

Holotype: F51996, station BSS 179 (39°03.2'S, 146°39.5'E, E of Wilsons Promontory; depth 55 m, muddy sand).

Diagnosis. Few basally united branches, partly repent, partly erect. Branches crooked, terete to angular, 5–10 mm thick. Softly spongy, elastic; dull greyish yellow, partly purplish in life. Surface smooth, hispid on branch tips. Oscules inconspic-

uous, stellate/petaloid, scattered, numerous. Armoured ectosome thin, discontinuous. Main skeleton twofold: (1) vague columns of detritus, (2) irregular net of clear spongin fibres.

Description. Ramose, branches partly repent, partly erect. Longer branches crooked, round to angular in cross-section. Branches 5 to 10 mm thick. Two repent branches 2 and 3 cm long. Erect branches 1 to 2 cm high. Specimen 3.5×6.5 cm wide, 2.5 cm high. Dull greyish yellow in life (2.5 Y 5-6/2-4) with faint purple tinge in places. Greyish yellow retained in alcohol. Softly spongy, very compressible and elastic.

Surface smooth to unaided eye, branch tips finely hispid. Oscules stellate or petaloid, 2 to 3 mm wide, regularly scattered on all sides, numerous. Thin armoured ectosome discontinuous, some areas with main skeleton exposed at surface, with oscules indistinct. Main skeleton is twofold: (1) Ill-defined columns of foreign debris agglutinated by spongin, barely visible around contours of grains and interstitially. Columns dendritic, straggling, 85 to 360 μ m wide. (2) Interstitial irregular meshwork of clear spongin fibres. No distinction of primaries and secondaries, diameters and meshsizes vary; similar to that in *Spongia hispida*, described below.

Remarks. The new species is comparable to *Psammoclema ramosum* in gross shape, but differs in its small stellate/petaloid oscules, and in the presence of an auxiliary reticulate skeleton of clear spongin fibres. *Psammoclema goniodes* is also ramose, but is distinct by its angular reticulation of fibres packed with detritus. See Remarks on *P. goniodes*, below.

***Psammoclema callosum* (Marshall)**

Plate 8 figure 1, plate 27 figure 4

Dysidea callosa Marshall, 1880: 104, pl. 6 fig. 12, pl. 7 figs 1-5 (probably Australia, Bass Strait?).

Material examined. Station KG 6, one specimen in 3 fragments (F51997). (Type material not found in PMJ and ZMB.)

Diagnosis. Small, compressed-lobate to contorted-frondose. Surface tuberculate. Leathery, but easily torn, greyish beige in life. Strong odour. Ectosome rough, firm packed with sand, 175-860 μ m thick. Oscules small, recessed, on top of conical elevations. Main skeleton an irregular, lax reticulation of straggling, knotty, clear spongin fibres with ill sorted detritus. Choanosome cavernous. Debris scarce in dense matrix, which is packed with bluegreen microsymmbionts.

Description. Convolute fronds or partly conrescent, compressed and tapering lobes, the latter

usually with volcano-shaped tips with slightly recessed minute oscules, 0.5-1 mm wide. Fragments 2 to 4 cm wide, with free individual lobes up to 1 cm high and 3-5 mm thick. Delicate branching algae and bryozoans partly overgrown by sponge. In life and in alcohol greyish beige (10 YR7/2-4). Leathery, rough and gritty. Characteristic, strong and persistent odour in preserved specimens, possibly due to microsymmbionts.

Surface regularly thrown into tubercles, around 1 mm high wide, 1-3 mm apart. Some partly confluent and elongate, forming short ridges. Regularly packed ill-sorted sand everywhere, with fine interstitial pores, mostly in rows, often forming reticulate pattern.

Ectosome 175-860 μ m thick, packed with foreign debris of wide size range, including many spicules and their fragments. Main skeleton of very irregular, lax and unoriented reticulation of straggling, knotty fibres, containing same kind of ill-sorted detritus as in ectosome, agglutinated and outlined by pale, clear spongin. Grains 80 to 350 μ m. Some debris interstitially. Choanosome regularly cavernous, yellowish in transmitted light, occasionally stratified below ectosome by meandering canals 40-60 μ m wide. Packed throughout with blue-green algae.

Remarks. A regularly and conspicuously tuberculate surface, without relation between tubercles and skeletal fibres, also occurs in *Phoriospongia carcinophila*, *Phoriospongia wilsoni* Dendy, and *Psammoclema nodosum*. The latter is sufficiently distinct from *Psammoclema callosum* by its larger size, massive shape, tough consistency, darker colour, coarser tubercles, much thicker ectosome, and poorly organised internal sand-skeleton.

There is a virtually unknown Australian species of *Phoriospongia* with relatively coarse surface-tubercles and a characteristic ectosome with very conspicuous skeletal ostia. It comprises some of the syntypes of *Sigmatella corticata* var. *papillosa* Lendenfeld (1889b, including the specimen figured on pl. 40 fig. 2). This species is also represented by two specimens (BMNH 1886.12.15.339 and 1886.12.15.340) with manuscript names by Carter and Lendenfeld.

***Psammoclema densum* (Marshall)**

Plate 8 figures 2-4, plate 27 figure 5

Psammopemma densum Marshall, 1880: 113, pl. 8 figs 6-11 (Tas.). — Polejaeff, 1884b: 46, pl. 3, figs 3, 4 (Port Jackson, NSW). — Lendenfeld, 1885a: 23. — Lendenfeld, 1889b: 640, pl. 37 fig. 4; pl. 41 fig. 17.

?*Psammopemma densum* var. *subfibrosa* Ridley, 1884a: 390, pl. 41 fig. h (Thursday Island, Torres Strait).

Holopsamma laevis Carter, 1885b: 212 (Port Phillip Heads).

Material examined. Station BSS 179, one specimen (F51998); station BSS 181, three specimens (F51999, F52000, F52001). Holotype of *Psammopemma densum* (ZMB). Type specimens of *Holopsamma laevis* (BMNH).

Diagnosis. Commonly small, incrusting, irregularly lobulate to concrescent-ramose, often overgrowing other objects, coarse detritus. Moderately compressible, easily torn. Greyish yellow to olive-brown in life. Oscules elongate, sinuous, variable in size and distribution. Surface almost smooth to variably verrucose, rugo-reticulate or rugo-vermiculate. Ill-sorted detritus mostly crowded throughout, poorly organised in choanosome, packed in little differentiated ectosome.

Description. F51999 and F52001 small, the former incrusting, the latter branching, originally attached to chaetopterid worm tubes with various other sponges. F52000 (pl. 8 fig. 3) irregular, with massive, somewhat depressed and lobose base, crooked branches, some short and simple, others composite, bushy or flabellate, with largely concrescent branchlets. Basal mass $2 \times 3 \times 1$ cm; single branches 5 mm long, 2–3 mm wide; composite branches up to 2.5 cm long and 12 mm wide. F51998 (pl. 8 fig. 2) massive, thrown into contorted, mostly compressed and concrescent lobes. Specimen $9 \times 5 \times 4$ cm, overgrows bivalve shells, fragments of bryozoans and large foraminifera, and bears delicate branching algae, bryozoans and hydroids. Largest specimen in life greyish yellow (5 Y 6–7/4) on surface, dull yellow (2.5 Y 7/8) inside, largely preserved in 70% alcohol (10 YR 6/2–4). F52000 olive-brown (2.5 Y 6/6), pale beige in alcohol. Firm, moderately compressible and resilient, easily torn, as in wet cardboard.

Oscules in largest specimen marginal on lobes, mostly elongate, sinuous, with rounded margins, about 1 mm wide and up to 4 mm long. Oscules in F52000 smaller, round, irregularly scattered in pits and clefts.

Surface almost smooth in some areas (particularly of largest specimen) but commonly tuberculate and rugose. Pattern mostly fine (rugae and tubercles 0.5 mm wide), coarse and more irregular in some places. Where relief most regular, particularly in F52000, tubercles joined by low ridges in clathrate or polygonal pattern, with interstitial pits. More often, meandering pattern of ridges and furrows. The latter contain membrane with reticulation of fine sand (spicule fragments), and interstitial ostia; pattern stands out where depressions wider, roofing regular square crypts, 0.5–1 mm wide.

Choanosome dense, microcavernous, except compressed atria branching inward in mesial por-

tions of lobes. Ectosome contains mostly packed debris of spicules. Crowded debris in choanosome with little organisation, ill-sorted and heterogeneous. Some less obstructed areas show threefold structure: (1) lax, irregular reticulation of straggling tracts with mostly fine detritus, chiefly spicule-fragments; (2) vague reticulation of brown, finely granular organic matter; (3) interstitial ill-sorted detritus, chiefly shelly and lithic. Clear interstitial choanosome packed by globular, mulberry-shaped bodies, around 13 μ m in diameter, presumably microsymbionts.

Remarks. Of all Australian species here assigned to *Psammoclema*, *P. densum* is the poorest in morphological definition, appearing almost featureless to cursory examination. It has also the most fragile consistency. See Remarks on *Phoriospongia carcinophila* and *P. kirki* (above).

Psammoclema fissuratum sp. nov.

Plate 8 figure 5

Holotype: F52002, Station BSS 187 (38°32.0'S, 142°28.6'E, 17 km S of Warrnambool; depth 52 m, coarse sand and shells).

Diagnosis. Complex-frondose. Fronds equally thick (5 mm), budding laterally at right angle, regularly expanding, bifid to polyfid (tending to dichotomy), with distal incisions of variable depths and widths. Firm, more compressible and resilient distally. Olive-brown, distally reddish in life. Oscules small, marginal on edges and tips. Surface smooth on faces, frayed (micropapillate) on tips. Ectosome thin, with regular detritus. Sand occupies half of choanosome in volume, in vague columns and enclaves agglutinated by clear spongin, rarely scattered. Isolated grains often connected by trellised thin spongin fibres.

Description. Four distally incised spatulate fronds, all in one plane, three being parallel out of edge of fourth frond. Transverse frond 2.5 cm long, 2 cm wide, divided by two incisions, the lower distinct, the upper a notch. First lateral frond at base of transverse frond, stubby and bifid. Middle one 2.5 cm long, 1.8 cm wide, bifid, with incision 1 cm deep. Tallest frond 3.5 cm high, originally dichotomous (one part cut off for sectioning), with median incision 1.5 cm deep, two shallow lateral incisions, outermost lobe truncate. Specimen mostly 5 mm thick. Olive-brown in life, now pale yellowish brown (10 YR 7/4), darker, reddish (2.5 YR 5–6/4) in distal parts of tall lateral lobes. Firm, little compressible in middle, moderately resilient distally.

Oscules regularly arranged along edges of fronds and distal lobes, round or elongate, sharp-rimmed, 0.5–1 mm wide.

Surface smooth to unaided eye, except finely pitted and frazzled tips of taller lateral fronds. Well-sorted sand grains conspicuous, crowded, with interstitial ostia not in distinct pattern.

Armoured ectosome frequently only 1–2 sand-grains thick, with much spicular detritus, chiefly on surface. One-half of volume of choanosome occupied by sand grains (including calcareous shell-debris), with few foreign spicules and their fragments, mostly packed in vague columns or irregular masses, rarely scattered. Mean grain size 175 μm . Grains agglutinated by colourless, barely visible spongin; thin clear spongin fibres with irregular, trellis-like meshwork between neighbouring grains.

Choanocyte chambers spherical to oblong. Typical sizes 64×39 , 38×29 , $47 \mu\text{m}$. Choanosome contains scattered spherical bodies, like mulberries, 10–12–15 μm in diameter, presumably microsymbionts.

Remarks. *Psammoclema fissuratum* is sufficiently distinct from congeners by its shape, in combination with the smooth, evenly microgranulate surface, and the regular marginal oscules. See also Remarks on *Psammoclema goniodes* and *Psammoclema stipitatum*, below.

***Psammoclema goniodes* sp. nov.**

Plate 8 figures 6, 7, plate 28 figures 1, 2

Holotype: F52060, station BSS 187 ($38^{\circ}32.0'S$, $142^{\circ}28.6'E$, 17 km S of Warrnambool; depth 52 m, coarse sand and shells). *Paratype:* F52059, station BSS 181 ($38^{\circ}39.8'S$, $144^{\circ}18.2'E$, 30 km SE of Lorne; depth 79 m, fine sand with chaetopterid worm tubes).

Diagnosis. Sparsely branched, base compressed-lobate, may be stipitate. Branches crooked, slightly compressed and tapering. Small specimens soft, limp, with conulose surface. Larger ones moderately resilient, mostly smooth, distally finely conulose. Oscules numerous, round, 0.5–1 mm wide, scattered on face of base, mostly lateral on branches. Armoured ectosome thin, indistinct. Main skeleton thoroughly angular reticulation of straggling spongin fibres packed with well sorted detritus, including many spicule fragments.

Description. Holotype (pl.8 fig. 7) comprises two tapering branches, strongly bent in same direction in upper portions, 35 and 50 mm long, 5 and 7 mm wide, slightly compressed. Branches arise from stipitate, frondose base 25 mm high and up to 13 mm wide in upper portion. Two short lobes (aborted branches) issue from one side below shorter main branch. Orange-brown in life (2.5 YR 5/6–8), now faded (5 YR 6–8/4). Firm, moderately

compressible and resilient. Surface optically smooth, but microconulose, more so on branch tips. Conules somewhat obscured by sand on surface. Oscules conspicuous, round, 0.5–1 mm wide, regularly scattered along edges of branches and on one side of frondose base. Paratype (pl.8, fig. 6) 9×17 mm, has lobose base surmounted by two tapering branches, all portions compressed in one plane. One branch looped in plane of compression. Originally attached to chaetopterid worm tube with other sponges. Colour in life not recorded, now cream. Softer than holotype, limp. Surface finely conulose, without conspicuous sand. Outermost transverse fibres form reticulate pattern of ridges between conules. Recessed fleshy interstices with fine secondary reticulum of spicule fragments, single ostia in meshes.

Main skeleton in holotype an angular and irregular reticulation of fibres, with little orientation and distinction by thickness, packed with detritus, mostly spicule fragments; few fibres with about equal proportions of other fragments. Very few interstitial inclusions. Most spicule fragments longitudinally arranged, but many oriented at random. Pale clear spongin agglutinating and enveloping detritus. Thickness of fibres 23 to 68 μm , mostly around 40 μm . Meshes triangular, rhombic and irregularly polygonal, rarely square, 23 to 150 μm wide. Peripheral portions with indistinct radial primaries and secondaries, like in irregular spider web. Towards surface, meshes smaller, more regular, less angular. Here, between choanosome and armoured ectosome, fibres packed by ill-sorted detritus, also interstitially. Spicular and other (lithic and shelly) components in about equal proportions, both interstitially and in fibres. Abundance of coarse grains higher at surface, armoured ectosome not distinct. Matrix of choanosome scanty, around irregular lacunae. Macrosymbionts of one kind. Fibres of paratype thicker than in holotype, more continuous, more straggling than angular. Packed detritus comprises more non-spicular components, spicular fragments more often disoriented. More interstitially scattered detritus, poorly sorted. In periphery, radial and tangential fibres more distinct than in holotype, primaries forming axes of conules and often curved in tips. No distinct armoured ectosome, only concentration of well sorted spicular fragments between fibres. Density of choanosomal matrix higher than in holotype.

Remarks. The proximal part in the larger specimen resembles individual fronds of *Psammoclema fissuratum* (described above). Fresh material of both species might reveal closer external similarity of whole specimens. The differences in structure of

the main skeleton (irregular distribution of sand internally, and anastomoses of clear spongin fibres between grains in *P. fissuratum*) are sufficient to distinguish the two species. The skeletal structure of *P. goniodes* (angular reticulation of sandy fibres) is also different from that of two other ramose congeners. The main skeleton of *P. ramosum* consists of very long, sparsely anastomosed fibres, longitudinal in the core, curving outwards and becoming radial below the surface. *P. bitextum* has a double texture of straggling columns of detritus and of reticulate clear spongin fibres.

Psammoclema nodosum (Carter)

Plate 8 figures 8–12, plate 27 figure 6,
text-figure 51

Sarcocornea nodosa Carter, 1885b: 214 (Port Phillip Heads, Vic.).

Spongelia nodosa. — Lendenfeld, 1889b: 670.

Dysidea nodosa. — Bergquist, 1980b: 482 (unrecognisable except as *Dysidea*).

Material examined. Station KG 2, one specimen (F52003). Type specimens of *Sarcocornea nodosa* (BMNH).

Diagnosis. Large, irregularly massive, heavy. Very firm, tough. Surface tightly tuberculate (nodose) to coarsely rugose, or brain-like; relief sometimes vague, or accentuated by superimposed coarser folds and meandering trenches (the whole reminiscent of pachyderm skin). Grey, often brownish, dark above and on exposed sides. Oscules conspicuous, marginal, irregularly scattered or clustered,

flush or elevated. Armoured ectosome a stratified, collagenous cortex around 1 mm thick, with regular, numerous erect ectochones underlain by intracortical crypts. Stratification also by sorting of detritus. Choanosome beige to dull ochre in life, dense, microscopically stringy (strands of algal microsymbionts). Internal detritus ill sorted, in vague, wide, dendritic and meandering tracts, some interstitially.

Description. Semi-encrusting on perpendicular rock face, outline round above, sinuous below. Now shrivelled and distorted by preservation. Apical volcano-like group of three concrescent oscular cones. Width 11 cm, height 10 cm, maximum thickness 4 cm. Compound oscular cone now compressed, 5.5 cm wide basally, 2.3 cm high.

Externally dark smoky grey above, light grey below, now generally more brownish (5 YR 4–5/1 above, 10 YR 7–8/2–4 below). Choanosome beige to dull ochre (10 YR 8/2 to 5 YR 6/6). Very firm and tough, moderately compressible, little resilient.

Surface bears strong and regular brain-like pattern, now much contracted, more pronounced than in life. Tubercles elongate, confluent in meandering groups occasionally branching, mostly 2–3 mm wide, up to 2–3 cm long, separated by dendritic and labyrinthic grooves 0.5–1 mm wide. Pattern weaker and mostly radial on oscular cone. Central portion near base with pattern of contorted cock's combs.

Surface almost smooth, finely hispid in parts, regularly scattered ostia everywhere, 25 μ m wide, spaced around 125 μ m. Distinct, stratified cortex, total thickness 750–1250 μ m. Outer cortex three-quarters of thickness, traversed by regularly spaced erect ectochones to often continuous intracortical crypts (text-fig. 51). Outer cortex mostly packed with ill-sorted detritus, about equal parts of spicular and non-spicular components, except surface, where spicular fragments dominate, often erect, producing faint hispidation. Inner cortex more collagenous, with better sorted detritus (spicular fragments often dominating) loosely scattered to crowded, extended inward in linings of large exhalant canals.

These are 1250 to 2500 μ m wide, irregular, often transversely folded. Walls with irregularly scattered mouths of finer canals, around 125 μ m in diameter. Main skeleton of moderately abundant, ill-sorted foreign detritus, in irregular fibres, or complex fenestrate to trellised systems, and interstitially. Matrix of choanosome dense, stringy, permeated throughout by wavy strands of filamentous algae.

Remarks. *Psammoclema nodosum* is as close to *P. vansoesti* (described below) as it is different from



Figure 51. *Psammoclema nodosum*, perpendicular section in reflected light, $\times 4.1$, showing cortex (with surface in perspective) with erect ectochones and layer of intracortical crypts. A large, much twisted exhalant canal is visible from lower centre to upper left.

all other congeners. In common with the former is the dark colour of the surface, the firm, tough, dense and heavy consistency, the well organised, thick collagenous ectosome (reminiscent of the cortex in Astrophorida), and the dense choanosome containing ill-sorted detritus in vague meandering tracts. *P. vansoesti* is chiefly distinct by its vase-or bowl-shape, by the coarsely rugo-reticulate/alveolate pattern on the sides or on the rim only, and by the numerous minute oscules regularly distributed in the apical concavity.

***Psammoclema radiatum* sp. nov.**

Plate 9 figures 1, 2

Holotype: F52004, station BSS 187 (38°32.0'S, 142°28.6'E, 17 km S of Warnambool; depth 52 m, coarse sand and shells).

Diagnosis. Several half-bowl-or ear-shaped, partly concrescent lobes jutting from common lacunose base, distally folded radially, marginally blunt, scalloped. Very firm, slightly resilient, crumbly, thoroughly and conspicuously sandy. Dull orange-brown in life. Thin pellucid dermis reinforced by reticulum of foreign spicules (few broken). Well sorted coarse sand grains crowded to packed internally without order.

Description. Capricious in shape, like baroque fountain, growing out from perpendicular rock face. Grossly lacunose base with 5 bowl-or ear-shaped protuberances in three directions, on different levels, roughly in same plane, but somewhat tilted and contorted. Upper faces deeply hollow to lacunose proximally, traversed by annular or transverse ridges distally. Margins narrowly rounded, sinuous, occasionally disrupted by small hollows or notches. Lower convex faces distally scalloped, mostly by radial coarse ridges and grooves, the former 2–3 mm, the latter 3–5 mm wide. In portions of uppermost bowl, and on convex face of lower protuberances, rugose pattern meandrine to reticulate, occasionally finer. Specimen 8 cm in width, 7 cm in depth, 6.5 cm in height. Largest excrescence on top 7 cm wide, 5 cm deep, 2–2.5 cm high. Lower ones 1.5 to 4 cm in width, 1.5 to 3 cm in depth; thickness 1 cm in middle, 2–3 mm at margins.

Dull orange-brown in life (7.5 YR 6/4), slightly more yellow (10 YR 6/4) in alcohol. Very firm, barely compressible and resilient, crumbly, conspicuously sandy.

Outer convex surfaces exhalant, packed with rounded lithic and shelly grains, 150–800 μm , mostly around 350–500 μm , with numerous oscules scattered in depressions. Oscules mostly 1–2 mm

wide, irregularly rounded, now covered by pellucid membranes. Sand in inner, concave faces packed only in ridges, elsewhere crowded to clustered. Interstices, up to 1 mm wide, and sand grains covered by pellucid dermis. Fine reticulum with interstitial ostia over subdermal crypts in wider interstices. Choanosome packed to crowded, without order, by sand as at surface. Thin superficial coat of foreign spicules, forming dermal reticulum. Most spicules entire megascleres. No spongin. Choanocyte chambers regularly oblong to spherical, typical dimensions 63 \times 52, 65 \times 44, 74 \times 64 μm .

Remarks. The capricious shape, thin dermis with mostly whole foreign spicules, and the abundance of coarse sand without internal order (hence crumbly consistency) distinguish this species from its congeners and all other thoroughly sandy species.

***Psammoclema ramosum* Marshall**

Plate 9 figures 3–6, plate 28 figures 3, 4

Psammoclema ramosum Marshall, 1880: 109, pl. 7 figs 12–15; pl. 8 figs 1–5 (Bass Strait). — Polejaeff, 1884b: 43, pl. 3 fig. 8, pl. 4 fig. 1 (off Monocour Island, Bass Strait, 70 m).

Chalinopsilla arborea var. *ramosa*. — Lendenfeld, 1888: 112 (old record). — Lendenfeld, 1889b: 152 (old record). — Guiler, 1950: 6 (Blackmans Bay, Tas.; record only).

Material examined. Station KG 7, one specimen (F52005). Holotype of *Psammoclema ramosum* (PMJ). Hypotype of *Psammoclema ramosum*: Polejaeff, 1884b (BMNH).

Diagnosis. Prolific long branches from common base, often repent throughout, concrescent laterally and dorso-ventrally. Branches commonly curved to bent, slightly depressed and nodose, 0.6–1.2 cm wide. Firm, moderately compressible, easily torn. Dark purplish or reddish grey. Surface smooth to finely rugo-reticulate. Oscules numerous, conspicuous, irregularly rounded, often elongate axially, mostly on upper faces only, often on top of nodes. Armoured ectosome thin. Main skeleton of crowded, straight, dendritic fibres, longitudinal in core of branches, curving outwards in periphery, becoming radial below surface, rarely anastomosing.

Description. Aggregate of repent, depressed branches. Three main branches issuing from common base, each repeatedly subdivided (more frequently below), partly concrescent along sides and on top of each other. Three minor branches from base, one short and recurved, middle one looped and partly concrescent with base, third free, with stubby secondary branch near base. This and

main branch gently s-curved. Main branches 5, 8, and 7 cm long, 1 to 1.2 cm wide, around 8 mm thick. Free minor branch 7 cm long, 5 × 8 mm thick. Length of specimen 14 cm, width at base 4 cm.

Dark grey, in life, with purple tinge above (5–7.5 RP 1/5–6), dull purple to reddish below (2.5 R 2/7 to 10 R 7/6) now faded to beige, with some greyish areas (2.5 Y 8–9/2–4 and 10 YR 6–7/2). Firm, moderately compressible and resilient, easily torn.

Oscules numerous, irregularly scattered on upper face of base and of main branches, rare on sides and below, irregular in outline, especially larger ones, elongate in different directions, drop-and-eye-shaped. Maximum width 1 to 3 mm. Margins mostly sharp, occasionally slightly recessed.

Surface smooth over most of upper faces; finely pitted, honeycombed or clathrate along sides, lower face and on branch tips. Ridges outlining pits in these areas mostly finely denticulate. Smooth surface microreticulate, with polygonal ostia interstitially.

Main skeleton chiefly of dendritic fibres, packed disorderly by moderately sorted detritus, with spicular and non-spicular fragments in equal proportions. Fibres longitudinal, straight, crowded in axial region, of irregular cross-section, often compressed, 120 to 280 µm thick; curving outwards in periphery, reaching surface obliquely or radially, becoming thinner, straggling, more widely spaced, branching and anastomosing sparingly. Pale clear spongin agglutinating and outlining fibres barely visible. Some detritus scattered interstitially. Ectosome armoured to variable degree, chiefly by foreign spicules and their fragments, 65–135 µm thick. Choanosome dense, crowded to packed by globular, mulberry-shaped microsymbionts, about 8 µm in diameter.

Remarks. Among the congeners, *P. bitextum* and *P. goniodes* are also ramose. They both differ from the present species in having smaller, less conspicuous oscules, and in their skeletal structures (see Remarks following the respective descriptions of the two species).

***Psammoclema stipitatum* sp. nov.**

Plate 9 figure 7, plate 28 figure 5

Holotype: F52006, station BSS 187 (38°32.0'S, 142°28.6'E, 17 km S of Warrnambool; depth 52 m, coarse sand and shells).

Diagnosis. Stalked, distally flabellate, fairly symmetrical. Stalk tall, basally expanded, terete, 8 mm thick below; compressed above, passing into flabellum about 1 cm thick, with crescent-shaped upper

margin. Firm, tough, moderately resilient. Olive to purplish brown, mottled. Surface transversely rugose on stalk, rugo-reticulate or rugo-vermiculate on flabellum. Rugae and pits 0.5–2 mm wide. Oscules small, inconspicuous, marginal on flabellum. Armoured ectosome 0.7–1.3 mm thick. Main skeleton an irregular reticulation of spongin fibres enveloping single and contiguous sand grains; hence most fibres knotty, lacunose. Much spicular detritus scattered interstitially. Filamentous microsymbionts throughout choanosome.

Description. Specimen stipitate and distally flabellate. Stem basally expanded into rhizome (now incompletely preserved), 4.5 cm high and 7–9 mm thick in its terete portion, transversely wrinkled. Compressed above, expanding, first to 2.5 cm, then abruptly into slightly asymmetrical flabellum, eye-shaped, 8 cm wide, 10–13 mm thick. Height of specimen 12 cm.

In life olive on one side, purplish brown mottled with olive on other. Shades darker in depressions, lighter in rugo-reticulation, now faded to greyish beige (7.5 YR 6–7/2–4) and dull red (5 R 5–6/4 on rugae, 5 R 5/2 in depressions). Firm, moderately compressible and resilient, tough.

Relief on both faces of flabellum distinctive. Pattern on two-thirds of one face a rugo-reticulation with lighter, sandy rugae, and optically smooth, oblong to irregularly sinuous depressions of variable size; width of rugae and depressions 0.5–2 mm. In remaining area, depressions vermiculate, dendritic and partly confluent, with rugae discontinuous, beset by low conules. Pattern finer, relief weaker than in rugo-reticulate area. Pattern of other face generally more cerebriform, with narrow vermiculate depressions and relatively wide rugae. Relief strong and coarse in one-third of face, fine and rather vague in remaining area. Depressions contain sieves of very crowded round ostia. Oscules small and inconspicuous, now contracted, numerous in depressions along edge of flabellum. Parallel radial atria in marginal portion of flabellum terete, 1–2 mm wide, 1–2.5 mm apart, linings with regular annular folds.

Ectosome armoured with sand grains and spicule debris, not stratified, 700 to 1300 µm thick. Main skeleton of sand grains agglutinated and encased by spongin, in irregular reticulation. Diameters and orientation of fibres extremely variable, no distinction of primaries and secondaries. Fibres often lacunose and trellised, some almost filled with debris, others partly, or devoid for short portions. Spongin often weakly and finely stratified, where stained. Choanosome contains scattered foreign spicules and their fragments, more densely,

sometimes packed, in canal linings. Choanosome permeated by filamentous algae in subparallel and crossed strands. Chaonocyte chambers indistinct, irregularly oblong, 33–58 μm long.

Remarks. The only other species among the Stylotellinae, here described, to have flabellate elements with marginal oscules, is *Psammoclema fissuratum*. Its body, however, is composite, with individual fronds regularly incised distally, the surface on faces being smooth. There is some similarity between the two species in skeletal structure, but the thin, clear spongin fibres connecting isolated grains in *P. fissuratum* do not occur in *P. stipitatum*.

***Psammoclema vansoesti* sp. nov.**

Plate 9 figures 11, 12, plate 28 figure 6,
text-figure 52

Holotype: F52008, station KG 6 (Tasmania, Winter Cove, E side of Deal Island, Kent Group; boulders with algae, depth 3–6 m). **Paratype:** F52007, station KG 3 (Tasmania, East Cove, W of jetty of settlement, Deal Island, Kent Group; outcrops and boulders with algae).

Diagnosis. Vase-to bowl-shaped, but irregular, angular, oblique. Outer side radially folded and rugose, or coarsely rugo-reticulate, with polygonal pits and tabulate, conspicuously sandy ridges. The latter pattern may be confined to the rim in some specimens. Reddish grey in life. Oscules minute, regularly scattered in the finely papillate concavity. Otherwise very similar to *P. nodosum*.

Description. Holotype (pl.9 fig. 11) an asymmetrical vase. Basal face of attachment with sinuous outline, inclined foreward at 45° to axis. Lower portion, 1–2 cm above base, constricted, with axially convoluted pillars and caverns of variable depth. Wall of vase expands slightly to margin along back and front, not along sides. Margin mostly rounded, fairly thick, of sinuous outline, generally sloping foreward at 30° – 45° to axis. Concavity regularly conical. Base of attachment 7×9 cm; constricted lower portion 5.5×6 cm; upper width across axis (maximum diameter) 8 cm; height along axis 9–10 cm; thickness of margin 1.3–2 cm; upper diameter of concavity 5 cm; depth of concavity 10 cm at back, 4.5 cm at front.



Figure 52. *Psammoclema vansoesti* sp. nov., perpendicular section in reflected light, $\times 6.6$. The cortical structure is similar to that in *P. nodosum*.

Greyish red in life, more grey in depressions (2.5 R 4-6/2), more red on rugae and on margin (2.5 R 6/6-8), more uniform in alcohol (10 R 4-5/2). Firmly rubbery, heavy, conspicuously sandy on rugae, margin and on upper concavity.

Irregular and coarse regoreticulation on much of the outer (inhalant) surface. Depressions between rugae mostly concave, 1-2 mm deep, vaguely polygonal to sinuous, some confluent in irregularly petaloid patterns, width 1 to 10 mm. Surface in depressions generally smooth, like in lower part of outer wall, which may be weakly sculptured (verrucose and pitted). Rugae 0.5-3 mm wide, tabulate to slightly convex, confluent with surface of margin in sandy structure and general level above depressions. Surface of margin mostly continuous, except few dark smooth pits. Parts of constricted base and most of sculptured area support encrusting and branching algae, hydrozoans and bryozoans.

Fine, barely visible (10 \times), regularly crowded ostia everywhere in darker, smooth areas and in depressions. Microscopic relief of conules and ridges, passing into fine reticulum of spicule fragments.

Exhalant concavity smooth to weakly sculptured, partly encrusted by serpulids, pierced by regularly scattered oscules, more conspicuous in life, now 0.2-0.5 m wide, spaced at 3-5 mm.

Paratype (pl. 9 fig. 12) a slightly oblique bowl, with wall partly convoluted axially. Basal pillars mostly continuous up outer wall, irregularly branching into thin ridges, hence fluted top of outer wall. Caverns around base extensive, confluent and meandering. Rugo-reticulate and pitted surface pattern only locally, near base, and along margin. Sandy structure of rugae on margin only. Prevailing secondary relief on outside verrucose, with pimples about 1 mm wide and high, 1-5 mm apart, often aligned and passing into serrated ridges.

Concavity regularly papillate, densely to 1-3 cm below the rim, loosely below. Most papillae bear apical oscules.

Height of paratype 7.5 to 11 cm, width at roughly triangular base 8-12 cm, upper diameter 12 cm, thickness of margin 8-10 mm, depth of concavity 8.5-11.5 cm.

Preserved paratype dark reddish grey (10 R 3-4/2) to dark beige (2.5 Y 7/2) externally, yellowish beige internally (5 Y 8/4). Cortex of smooth inhalant areas compound, stratified, 1000 to 1300 μ m thick. Outer layer (quarter to third of total) with parallel and perpendicular ectochones about 20 μ m wide and 100 μ m apart (text-fig. 52), packed with spicule fragments, mostly without orientation, locally erect. Inner layer contains scattered to

packed sand grains and few foreign spicules and their fragments. Interstices often correspond to fine stratified crypts, lowest layer discontinuous between cortex and choanosome.

Main skeleton similar to that in *Psammoclema nodosum*, but detritus even less sorted and less abundant in fibres, with spongin more evident, weakly and irregularly stratified. Interstitial detritus chiefly loosely strewn spicule fragments. Cortex contains scattered to crowded algal microsymbionts, sinuous fibrils tapering both ways from median inflation, filled with opaque granules, 7 μ m in median thickness, 65 μ m in length. Choanosome contains same type of filamentous algae as *Psammoclema nodosum*, but far less abundantly.

Etymology. The new species is dedicated to Dr R.W.M. van Soest (Amsterdam) in appreciation of his important contributions to sponge taxonomy and to the knowledge of the West Indian sponge fauna.

Remarks. The only close relative of this species is *Psammoclema nodosum*. It differs in its irregularly massive, never concave shape, its tightly tuberculate to brain-like surface, and its conspicuous, irregularly scattered oscules only on uppermost elevations.

Mycalidae Lundbeck, 1905, sensu van Soest, 1984

Mycale Gray

[*Esperia*] Nardo, 1833: col. 522 (junior homonym of *Esperia* Huebner, 1825).

[*Acamas*] Duchassaing and Michelotti, 1864: 95 (junior homonym of *Acamas* de Montfort, 1808).

Mycale Gray, 1867a: 533. — Thiele, 1903a: 949 (revision, revival of name). — Lundbeck 1905: 23 (definition, discussion), 29 (redescription of type species). — Hentschel, 1913: 263, 265 (tables of spicular dimensions for 112 species). — Topsent, 1924: 77-118 (revision of European species), 83, 86f. (revision of nominate subgenus). — Van Soest, 1984: 9-14 (definition, revision), 31 (discussion).

Aegagropila Gray, 1867a: 533. — Vosmaer and Pékélharing, 1898: 19. — Topsent, 1924: 78, 83 (revision as subgenus of *Mycale*). — Van Soest, 1984: 12, 16 (as subgenus of *Mycale*).

Grapelia Gray, 1867a: 534. — de Laubenfels, 1936a: 213 (genus dubium). — Vacelet, Lévi and Vasseur, 1976: 51f. (retained as subgenus of *Mycale*).

Carmia Gray, 1867a: 537. — Topsent, 1924: 83f. (revision as subgenus of *Mycale*). — de Laubenfels, 1936a: 118 (definition, revision). — Lévi, 1956b: 16 (discussion of Indo-Pacific species, *Aegagropila* implicitly synonymised). — Lévi in Brien et al., 1973: 610 (definition as genus in Mycalidae). — Van Soest, 1984: 12, 24 (as subgenus of *Mycale*).

Raphioderma Bowerbank in Norman, 1869: 333.

Raphioderma Bowerbank, 1874a: 235 (objective synonym of *Mycale*).

Esperella Vosmaer, 1885 (in 1887): 353, 354 (nomen novum for *Esperia* Nardo). — Ridley and Dendy, 1887: 62. — Dendy, 1905: 159.

Pseudoesperia Carter, 1886h: 455, 456. — Hallmann, 1914c: 399 (synonymised with *Grapelia*, subgenus of *Mycale*). — de Laubenfels, 1936a: 121 (definition, discussion). — Vacelet, Vasseur and Lévi, 1976: 51 (synonymised with *Grapelia*).

Arenochalina Lendenfeld, 1887a: 821. — Hallmann, 1912: 252 (type species redescribed, synonymised with *Mycale*). — Hallmann, 1914c: 399. — Burton, 1932a: 293 (Hallmann, 1912, confirmed; revised diagnosis erroneous, not new species). — Pulitzer-Finali, 1982b: 102 (discussion).

Zygomycala Topsent, 1930b: 431. — [Hallmann, 1914c: 406 (list of species of *Mycale* with isochelae, originally included in *Zygomycala* by Topsent). — Hentschel 1911: 299, 301 (remarks on *Mycale* spp. with isochelae)]. — Lévi, 1956t: 16 (discussion, review). — Lévi in Brien et al., 1973: 610 (definition in Mycalidae). — Van Soest, 1984: 16 (as synonym of subgenus *Aegagropila*).

Acamasina de Laubenfels, 1936a: 117 (nomen novum for *Acamas* Duchassaing and Michelotti). — Van Soest, 1984: 13, 28 (discussion, definition, redescription of type species).

Mycalecarmia de Laubenfels, 1936a: 120. — Van Soest, 1984: 10 (discussion).

Diagnosis. "Mycalidae with subtylostylote megascleres and palmate anisochelae; other microscleres may include toxa, raphides, micracanthoxea and palmate isochelae." (Van Soest, 1984: 9).

Remarks. This is an exceptionally large and difficult genus. Various attempts at revision and synopsis have been made. A résumé of these and a new revision are found in van Soest (1984: 9f.). Past revisions can be classed in two groups: (1) that, represented by de Laubenfels (1936a) and Lévi (1956b, of Indo-Pacific species), which relies on spiculation alone, and (2) that, represented by Topsent (1924), which is also based on other traits, notably of skeletal structure. The former approach is pragmatic and leads to splitting into artificial genera, the second is more difficult, but phylogenetically more sound, and leads to subdivision into subgenera. I have no doubt that the subgenera advocated by van Soest, based on Topsent's approach as applied with minor modifications to extra-European, chiefly West-Indian species, will eventually be applicable to all Indo-Pacific species involved. It so happens that the only species of *Mycale* in the new identified material clearly falls within the subgenus named *Acamasina* by van Soest. The proper name for this subgenus, however, for reasons of priority, is *Arenochalina*.

Subgenus *Arenochalina* Lendenfeld, 1887

Synonym: *Acamasina* de Laubenfels, 1936

Diagnosis. "Mycale without ectosomal skeleton. The choanosomal skeleton consists of a coarse rectangular reticulation of thick spicule tracts, completely enveloped in a spongin coat. Interior cavernous with scanty fleshy parts. Spiculation: subtylostyles, anisochelae and sigmata." (Van Soest, 1984: 28, for *Acamasina*). Primary fibres are frequently cored by foreign debris.

Mycale (Arenochalina) mirabilis Lendenfeld

Plate 9 figures 8–10, 13, plate 10 figures 1, 2, plate 29 figures 1–4, text-figures 53–56

Arenochalina mirabilis Lendenfeld, 1887a: 821, pl. 26 fig. 70, pl. 27 fig. 28 (Torres Strait). — Lendenfeld, 1888: 103. — Whitelegge: 1902a: 212, 213 (type slide AM G3528, from nodule, re-examined; new record from Port Jackson possibly *M. (A.) flammula*). — Pulitzer-Finali, 1982b: 100, text-fig. 12 (Great Barrier Reef).

?*Arenochalina mirabilis*. — Whitelegge, 1906: 466 (off Shoalhaven Bight, NSW). — Guiler, 1950: 6 (Seven Mile Beach, Tas., record only).

nec *Arenochalina mirabilis*. — Whitelegge, 1901: 76, pl. 10 fig. 7 (= *Mycale (Arenochalina) flammula*).

Mycale (Arenochalina) mirabilis. — Hallmann, 1912: 252 (schizotype AM G3538 re-examined, discussed).

?*Cavochalina truncatella* var. *laxa* Lendenfeld, 1887a: 763 (Port Chalmers, New Zealand). — Burton, 1927a: 292 (holotype redescribed as *Mycale* sp.).

Esperella spongiosa Dendy, 1896: 16 (Port Phillip Heads).

Mycale spongiosa. — Hentschel, 1913: 263, 265 (No. 1 in synopsis). — Burton, 1928: 119 (description, discussion, *Mycale fistulata* Hentschel with var. *macrochela* synonymised). — de Laubenfels, 1936a: 117 (discussion). — Thomas, 1973b: 36, pl. 2 fig. 8, pl. 5 fig. 9, pl. 7 fig. 8 (description, comparative table of spicule measurements; Mahe, Seychelles). — Van Soest, 1984: 13, 31 (type examined, included in subgenus *Acamasina*).

Mycale imperfecta Baer, 1906: 20 pl. 2, fig. 5; pl. 5, figs 3–8 (Zanzibar). — Hentschel, 1913: 263, 265 (No. 14 in synopsis).

Mycale fistulata Hentschel, 1911: 292, text-fig. 4 (WA). — Hentschel, 1913: 263, 265 (No. 37 in synopsis).

Mycale fistulata var. *macrochela* Hentschel, 1911: 294 (WA). — Hentschel, 1913: 263, 266 (no. 24 in synopsis).

?*Mycale tylostrongyla* Pulitzer-Finali, 1982b: 102, text-figs 13, 14 (Great Barrier Reef).

Material examined. Station KG 1, one specimen (F52014); station KG 7, three specimens (F52015, F52016, F52017). Station BSS 127 (40°00'S, 144°22'E, SE of King Island, 47 m, not covered in this report), one specimen. Holotype of *Arenochalina mirabilis*, Torres Strait (BMNH 1886.8.27.587, dry, here on pl. 9 fig. 13). 22 wet syntypes of *Esperella spongiosa* Dendy (NMV).

Diagnosis. Variably lobate, massive, contorted, erect or repent, sometimes with pedicel. Softly spongy, very compressible. Much slime upon collecting, with dermis and choanosome more or less

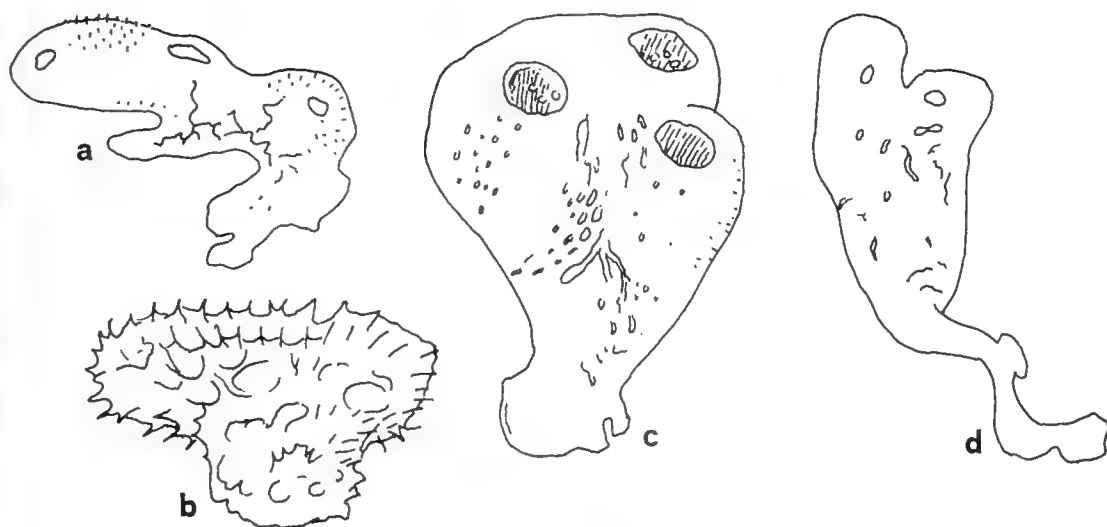
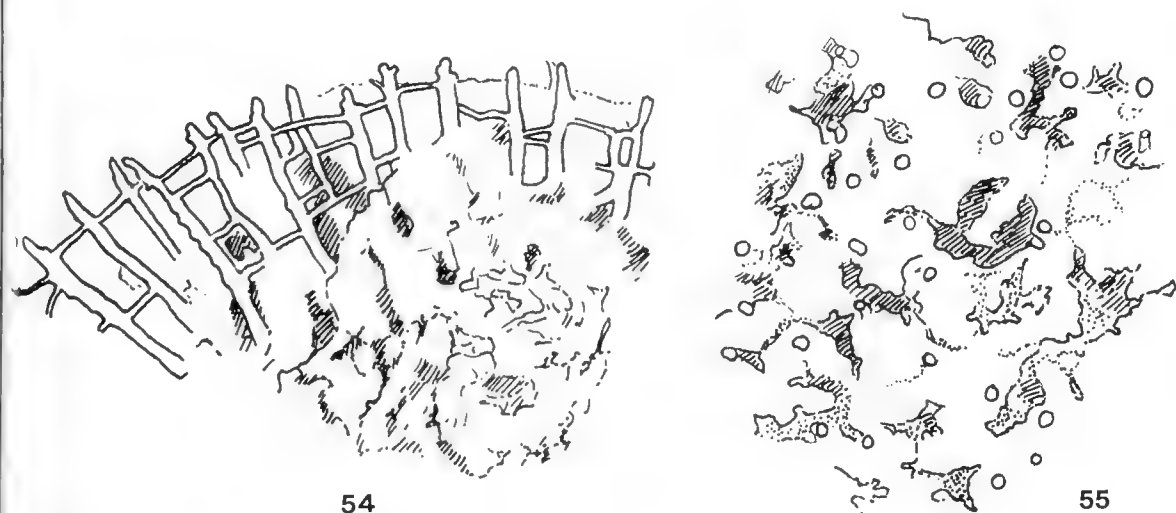


Figure 53. *Mycale (Arenochalina) mirabilis*, range of shapes (not to scale). a. F52014. b. F52016. c. F52015. d. F52017.



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Figures 54, 55. *Mycale (Arenochalina) mirabilis*, details from F52014, in reflected light, $\times 6.5$. Figure 54. Largely macerated portion, in perpendicular section, showing peripheral skeleton. Figure 55. View of surface, with piercing ends of primary fibres and subdermal cavities partly open and enlarged through shrinkage.

deciduous. Dermis and choanosome mostly yellowish cream to beige in life, with some pink and greenish. Fibres conspicuous, dark red to purple in life. Vermiculate subdermal canals; dermis tends to crack when exposed. Oscules conspicuous, apical on lobes, often with much smaller, scattered ones. Surface comulose to bristly, with commonly blunt primary fibre tips piercing dermis. Some specimens with coarser, widely spaced fibres, with longer conules and tapering fibre tips. Other specimens fleshier, with thicker, more continuous dermis, surface then smoother. Fibrous skeleton mostly regular, meshsize around 1 mm; primaries cored by

foreign debris. Meshwork in some specimens lax, less regular, primaries then with few foreign inclusions. Most fibres contain filamentous algae. Microscleres usually rare.

Description. Shape variable (text-fig. 53), generally lobate, more or less massive, often contorted. Pedicel may be developed. Largest specimen (F52015, pl. 9 figs 9–10), with three conrescent clubshaped tubes, 10 cm high, 6×7 cm wide. Specimen from station BSS 127, 9 cm high, 11×23 cm wide.

Softly spongy, very compressible and resilient.

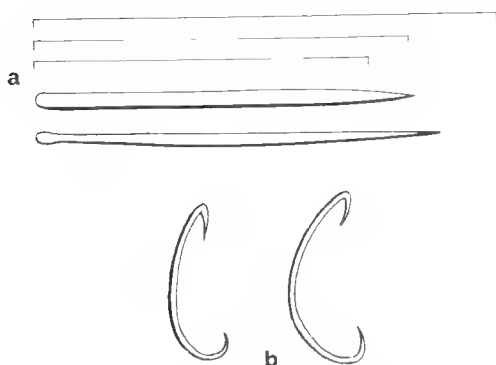


Figure 56. *Mycale (Arenochalina) mirabilis*, spicules, $\times 260$. a. Styles and subtylostyles in F52014. b. Sigmata in F52016.

Dermis and choanosome mostly yellowish cream to beige in life, with obtuse tinges of pinkish purple and greenish: in F52014, mostly 2.5 Y 9/4, locally 5 R to 2.5 Y 9/2; in F52015, 5 YR 8-9/2; in F52016, mostly 2.5 Y 9/6-8, locally, on surface, tinges of 5-7.5 RP 9/4. Fibres in life dark red to purple (7.5 - 10 RP 6/6-8 to 2.5 R 4-5/2). Upon removal from sea, flesh contracts, with copious extrusion of slime; most noticeable in rarer phenotype with coarse skeleton (F52016). In form with fine, more regular skeleton, thin dermis (remaining specimens), process slower, appearing first as cracking of dermis, red-purple colour of skeleton strongly contrasting with pale dermis. Little remains of choanosome in specimens not immediately preserved, dermis remaining in peals and flakes. In alcohol cream to pale beige, with fibres bleached. In specimen from station BSS 127, and in some types of *Esperella spongiosa* Dendy, dark greyish beige to light hazel.

Surface in finely textured specimens with scanty flesh, finely conulose to hispid, with tips of principal fibres generally protruding (piercing dermis) even in life. In F52016 surface spiny, with prominent tapering tips of primaries. In fresh specimens of former kind, mouths of numerous perpendicular inhalant canals conspicuous through dermis. Pattern locally interrupted by subdermal, tangentially meandering and dendritic canals. Both sorts about 1 mm wide and quickly exposed after collecting.

Oscules of two sorts: larger ones, 6-13 mm wide, on apices of lobes, with sharp fleshy and skeletal rims, leading to axial atria tapering to various depths; smaller ones, more numerous and scattered, 3-4 mm wide, with less defined rims, often composite (confluent). Either one or both on same specimen.

Fibrous skeleton of finer form regularly reticulate. Primaries parallel, straight or straggling in axial portion of lobes (longitudinal in linings of atria), curving radially to surface, reached at right angles, 200-300 μm thick, 0.5-1.5 mm apart. Their free tips (hispid surface) 0.3-0.8 mm long. Secondaries 50-100 μm thick, 0.5-1.7 mm apart.

In finer specimens all primaries contain foreign detritus of variable distribution and sorting, spicular and non-spicular fragments in about equal proportions, thickly coring fibres, with spongin coating grains thickly and evenly. With poor sorting, fibre contours knotty. Spongin in coats stratified, irregularly wavy laminae often tapering and cut off. Proper megascleres in primaries never abundant, commonly oriented at random. Secondaries cored by proper megascleres only, usually parallel, several abreast, a few oblique. At junctions, secondaries expand like trumpet bells, with coring megascleres fanned out. Few oblique spicules (proper and foreign) protrude from primary and secondary fibres, commonly enveloped by spongin. Secondaries occasionally branch and may have free, rounded ends. All fibres contain numerous strands of filamentous, segmented algae.

Choanosomal matrix in this form (F52015, F52017) contains numerous (in the former abundant) proper megascleres in confusion. Microscleres very rare: only two weak anisochelae were seen in one section (F52015). In coarsely textured form (F52016, pl. 10 figs 1-2), distances between primaries and between secondaries commonly 1-5 mm. Free tapering tips at surface up to 8 mm tall. Primaries 270-430 μm thick, secondaries 55-350 μm . Scarce foreign inclusions in primaries, many algal filaments in all fibres. Primaries filled with megascleres in confusion or in semiplumose arrangement, marginal ones occasionally protruding, encased in spongin, hence thorny contour of some fibres. Megascleres more common in secondaries than in finely textured form, always coated by clear spongin. Choanosomal matrix with numerous megascleres, mostly aligned. Microscleres scarce but more numerous than in other specimens, sigmata only. As in other two specimens, scattered microsymbionts of mulberry-shape, 12-15 μm in diameter. In this specimen only, ovate, deeply staining structureless bodies, 10-16 μm long.

Spiculation: (1) Straight, fusiform subtylostyles with elongate, occasionally subcylindrical heads; greatest width two-thirds below head. In F52016, points short, often blunt (strongyloxeote to strongylote), occasionally mucronate. Axial canals commonly wide, eroded. Rare anisoxea in F52015. Individual measurements:

F52014: 160–179–194 \times 2.9–4.8–7.3 μm .

F52015: 164–179–222 \times 2–3.7–5.8 μm .

F52016: 217–242–268 \times 1.9–4.4–7.2 μm .

Microscleres: (2) two weak anisochelae in F52015, length 19.6–23.4 μm ; width, in side view, 5.3–5.0 μm ; length of free ends 5.7/6.1 and 6.0/10.0 μm . (3) Sigmata (8 measured in F52016), symmetrical or contorted: length 73.8–86.2 μm ; total width 28.5–35.3 μm ; thickness of shaft 2.5–3.6 μm .

Remarks. It could be argued that the coarsely textured form belongs to a distinct species or subspecies. Among the 22 syntypes of *Esperella spongiosa* Dendy deposited in the Museum of Victoria is at least one specimen with a similarly lax and coarse fibrous skeleton, and some intermediate specimens. Many of Dendy's specimens are more fleshy than the new ones, with a thicker, continuous dermis, and have a more irregular fibrous meshwork, with many free secondaries. I doubt that the fleshy consistency is the result of immediate preservation. It helps to support the view that this is a very polymorphic species.

In further support of this assumption are some comments by Dr K. Rützler (in litt., 7 October, 1983) concerning his study of West Indian populations of *Mycale (Arenochalina) laxissima* Duchassaing and Michelotti. The species was recently redescribed by van Soest (1984: 29, text-fig. 9, pl. 3 fig. 1). It is certainly closely related to *M. mirabilis*, as his discussion (p. 13, under (4), and p. 31, with reference to *Mycale spongiosa* and *M. fistulata*) makes clear. While van Soest did not speak of polymorphism in this context, Rützler's remarks were very suggestive of wide phenotypic manifestation.

Rützler's spicule measurements (in litt., for specimens from Colombia to Florida) show considerable variability (megasccleres being generally larger than in *M. (A.) mirabilis*, but also weakly mineralised). Microscleres may be rare, particularly in specimens from the Bahamas. These specimens, which I have badly misidentified as *Thorecta horridus* (see Wiedenmayer, 1977a: 70, pl. 8 figs 2–4, pl. 9 fig. 1), are suggestive of the present coarsely textured, conulose form. Rützler (in litt.) has found filamentous algae within the fibres of specimens from Belize. In view of this polymorphism in *Mycale (Arenochalina) mirabilis*, and of the occurrence of subtylostongyles in one of the new specimens, it seems likely that *Mycale tylostongyla* Pulitzer-Finali is a junior synonym. A further synonym may be *Gelliodes setosus* Keller (1889: 376; holotype: ZMB 276), known from the Red Sea and Indonesia, whose only distinctive trait, according

to van Soest (1984: 31) is the abundance of sigmata. There are two other Australian species in this subgenus: (1) *M. (A.) flammula* (Lamarck) (see Topsent, 1933: 17), with synonyms *Spongia anaptipes* Lamarck (see Topsent, 1930a: 35), *Arenochalina mirabilis*: Whitelegge (1901: 76, pl. 10 fig. 7), and *Spongelia elegans*: Lendenfeld (1889b: 655, part, Australian hypotypes only, including pl. 39 fig. 2 = BMNH 1886.8.27.215); and (2) *M. (A.) pluriloba* (Lamarck) (see Topsent, 1930a: 28). Rare microscleres probably occur in both and were usually overlooked, with exception of Hallmann (1912: 252, footnote), who noted anisochelae in *A. mirabilis*: Whitelegge.

M. (A.) flammula has a distinct shape: pedunculate, flabellate with radial distal incisions. *M. (A.) pluriloba* consists of clustering compressed lobes, issuing and regularly widening from a narrow base, distally truncate and incised.

Tedaniidae Ridley and Dendy, 1886

Synonym: Myxillidae Topsent, 1928, sensu van Soest, 1984.

Tedania Gray

Tedania Gray, 1867a: 520. — Wiedenmayer, 1977a: 133 (references, status of type species). — Van Soest, 1984: 49 (definition in Myxillidae).

Trachytedania Ridley, 1881: 122. — Topsent, 1928: 53 (probably a synonym of *Tedania*). — Burton, 1932a: 306 (synonymised with *Tedania*).

Tedaniopsis Dendy, 1924: 366. — Topsent, 1928: 54. — Burton, 1932a: 345 (synonymised with *Tedania*). — de Laubenfels, 1936a: 54 (definition, revision). — Van Soest, 1984: 53 (possibly to *Hemitedania*).

Paratedania Burton, 1929a: 441. — Burton 1932a: 306, 345 (discussion, synonymised with *Tedania*). — Van Soest 1984: 54 (type species, misspelt *tarantula*, possibly to *Hemitedania*).

Diagnosis. “[Tedaniidae] with onychaetes as microscleres (but without chelae or sigmata); ectosomal tyloles are terminally microspined and choanosomal styles are smooth.” (Van Soest, 1984: 49.) Dendritic spicular tracts may be present.

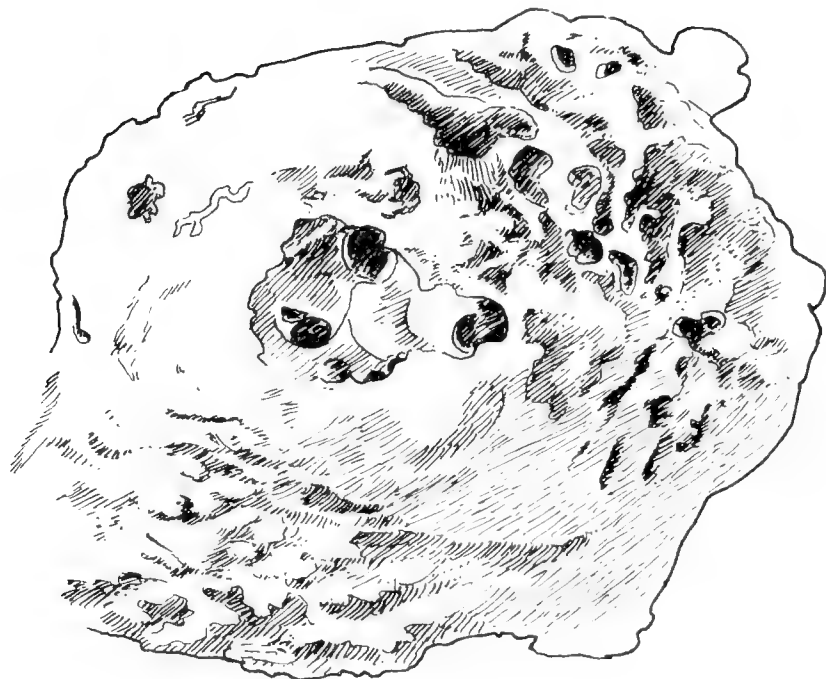
Tedania anhelans (Lieberkühn)

Plate 1 figure 7, plate 10 figures 3–7,
plate 29 figures 5, 6, plate 30 figure 1,
text-figures 57–62

Selected synonymy.

Halichondria anhelans Lieberkühn, 1859: 521 pl. 11 fig. 6 (only style and onychaete; description composite, exterior that of *Reniera inflata*, fide Schmidt, 1868: 28, Trieste, Adriatic Sea).

Myxilla anhelans. — Schmidt, 1862: 72 (schizotype re-examined, overlooked tyloles found; Kvarner, Adriatic Sea).

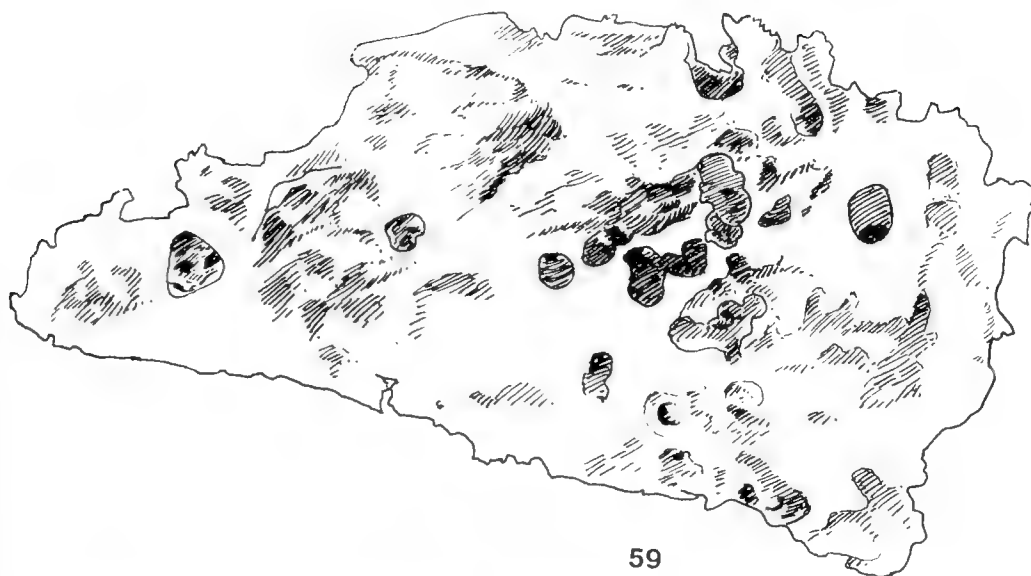


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Figures 57, 58. *Tedania anhelans*. F52009, a conical specimen with a compound apical oscule, $\times 4.1$. Figure 57. From top. Figure 58. Median section.



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Figures 59, 60. *Tedania anhelans*. F52010, a small, cushion-shaped specimen, $\times 4.1$. Figure 59. Top view. Figure 60. Perpendicular fracture.

Tedania anhelans. — Hechtel, 1965: 38 (comparison with *Tedania ignis*, discussion). — Boury-Esnault, 1971: 312 (shape, colour, reproduction, ecology; Banyuls, W Mediterranean). — Thomas, 1973b: 29, pl. 1 fig. 15 (Mahe, Seychelles). — Pulitzer-Finali, 1978: 57 (description, ecology). — ?Boury-Esnault, 1973: 282, fig. 37 (description, Brazil, from Recife to S of Bahia; references to records in Senegal and South Africa). — Pulitzer-Finali, 1983: 561 (description, ecology). — Van Soest, 1984: 52 (comment on synonymy in Burton and Rao, 1932, as *Tedania nigrescens*, see below).

Tedania anhelans var. *digitata*. — Topsent, 1936a: 23 (résumé, colour, ecology, spongin, distribution in Western Mediterranean).

nec *Tedania anhelans*. — Burton, 1954: 229 (= *Tedania ignis* fide Hechtel, 1965: 37).

?*Reniera nigrescens* Schmidt, 1862: 74 (Kvarner, Yugoslavia: description that of a *Reniera* in the modern sense).

Tedania nigrescens. — Burton and Rao, 1932: 353 (excessive synonymy, discussion; Indian Ocean). — Burton, 1932a: 346, text-fig. 44 (excessive distribution). — Burton, 1937: 27, pl. 3 fig. 22 (diagnosis).

Reniera digitata Schmidt, 1862: 75, pl. 7 fig. 11 (Venice).

Tedania digitata. — Ridley, 1884a: 417 (Torres Strait). — Carter, 1886a: 52 (Port Phillip Heads, Vic.). — Ridley and Dendy, 1887: 51, pl. 11 fig. 3 (off Port Jackson). — Dendy, 1887c: 157 (Gulf of Mannar, India). — Dendy, 1895: 258 (Port Phillip Heads, Sorrento, Queensland, Vic.). — Topsent, 1897: 453 (Ambon, Indonesia). — ?Lindgren, 1898: 299, pl. 19 fig. 10 (Southern Viet Nam). — Topsent, 1904: 176 (Azores). — Baer, 1906: 17 f. (3 varr. nov., East Africa). — Lundbeck, 1910: 4-6 (discussion). — Hentschel, 1911: 332 (Western Australia). — Hentschel, 1912: 348 (discussion; Arafura Sea). — Topsent, 1920a: 16 (*Reniera nigrescens*, *R. muggiana*, *R. digitata* synonymised, redescription of type material). —



Figure 61. *Tedania anhelans*. F52011, view of base, $\times 5$. The basal membrane is draped in the large canals, but otherwise stripped. The exposed choanosome contains eggs or embryos (some embedded in the pinacoderm), and (above and below) sand.

Dendy, 1922: 99 (Indian Ocean).—Shaw, 1927a: 434 (Maria Island, Tas.).—Topsent, 1928: 247 (W. Mediterranean, Cap Verde Islands).—Koltun, 1959: 159, text-fig. 117, pl. 25 fig. 1 (Japan Sea).

Tedania digitata var. *verrucosa* Carter, 1886a: 53 (Port Phillip Heads, Vic.).—Dendy, 1895: 258 (holotype re-examined).

Tedania digitata var. *fibrosa* Ridley and Dendy, 1887: 51 (off Port Jackson).

Tedania digitata forma *inermis* Hentschel, 1911: 333 (Western Australia).

Tedania digitata forma *polytyla* Hentschel, 1911: 333, text-fig. 24 (Western Australia).

Reniera ambigua Schmidt, 1864: 39, pl. 4 fig. 8 (Yugoslavia).

Suberites panis Selenka, 1867: 570, pl. 35 fig. 16 (Port Phillip Bay, Vic.).

Tedania panis.—Thiele, 1903a: 946, pl. 28 fig. 11a–c (holotype re-examined, measurements and figures of spicules).

Reniera muggiana Schmidt, 1868: 28 (Trieste, Adriatic Sea).

Tedania rubicunda Lendenfeld, 1888: 190 (Port Jackson).

nec *Tedania rubicunda*.—Hentschel, 1911: 334, text-fig. 25 (fide Hallmann, 1914).

Tedania digitata var. *rubicunda*.—Hallmann, 1914b: 366, text-fig. 11, pl. 17 fig. 4 (syntype in AM redescribed).

Tedania rubra Lendenfeld, 1888: 191 (Port Jackson).—Whitelegge, 1889: 185 (off Balls Head, Port Jackson).

Tedania digitata var. *rubra*.—Hallmann, 1914b: 371, text-fig. 12 (syntype in AM redescribed).

Clathrissa elegans Lendenfeld, 1888: 218 (Port Jackson and Port Phillip Bay, the latter unpublished).—Whitelegge, 1889: 186 (Maroubra Bay, NSW).—Hallmann, 1912: 146.—Hallmann, 1914a: 267, 412 (as species dubia, type material in AM overlooked).

Tedania assabensis Keller, 1891: 313, pl. 16 figs 11, 12 (Red Sea).—Row, 1911: 353 (Red Sea).—Burton, 1927b: 81 (Red Sea, Suez Canal).

Tedania anhelans forma *assabensis*. Lévi, 1965a: 17, text-fig. 19 (Red Sea).

?*Tedania ignis* (Duchassaing and Michelotti): de

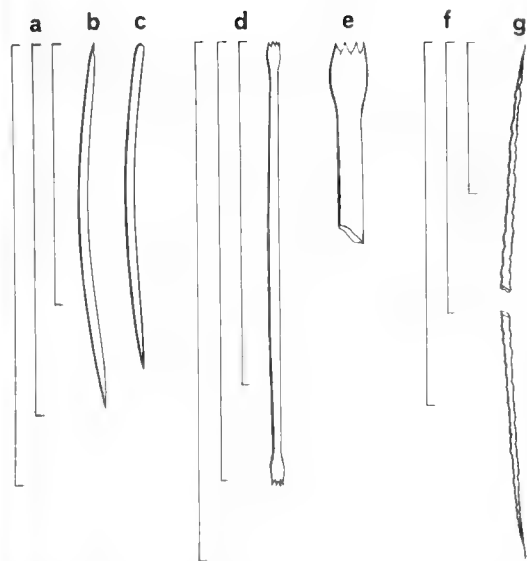


Figure 62. *Tedania anhelans*, spicules from F52009. a-c. Range and examples of styles and oxea, $\times 263$. d. Tyloste, $\times 263$. e. Enlarged end of tyloste, $\times 790$. f. Range of onychaetes, $\times 263$. g. Enlarged ends of onychaete, $\times 790$.

Laubenfels, 1950a: 21, text-fig. 13 (Hawaii). — de Laubenfels, 1951: 260 (Hawaii).

?*Tedania ignis pacifica* de Laubenfels, 1954a: 129, text-fig. 81 (Caroline Islands, Micronesia).

Material examined. Station KG 2, two specimens (F52009, F52010); station KG 4, one specimen (F52011); station KG 6, two specimens (F52012, F52013); station BSS 181, two specimens (F51939, F51940). Type specimens of *Tedania digitata* var. *verrucosa* (BMNH), *T. digitata* var. *rubicunda*, *T. rubra*, *Clathrissa elegans* (AM and BMNH). Hypotypes of *Tedania digitata*: Carter, 1886a (BMNH), Dendy, 1895 (NMV).

Diagnosis. Shape and size variable: thinly encrusting, cushion-shaped, massive-lobate, digitate to stubby-ramose, tubular, irregularly frondose, or trabeculate, often in combination in large specimens. Softly rubbery, limp to moderately firm, compressible. Colour variable: fresh surface bright orange to vermilion, or brown, ochre, dull green, bluish, grey, blackish. Superficially orange specimens often with other, darker hue in periphery. Frequently found as epibionts on algae and sessile invertebrates. Surface smooth to vaguely verrucose, rugose, or brain-like. Digitate and frondose protuberances often longitudinally striate to ridged. Oscules conspicuous, mostly apical on lobes, often clustered or composite. Vestibules well developed, paratangential and dendritic-meandering, or ascending, palisade-like. Ectosome reinforced by tangential bundles of tyloste, or by extensions of

peripheral umbels and penicils of ascending spicular tracts.

Choanosome cavernous, bread-like, with sand in some specimens. Main skeleton an irregular, often vague renieroid reticulation of spicular tracts with scarce spongin, frequently masked by spicules in confusion. Few thicker, more compact longer tracts may occur, mostly dendritic. Tyloste with few distal spines. Some oxea (styloids) may occur.

Description. Small, thickly encrusting to cushion-shaped, mostly not over 6 cm in width. Smallest specimens from station BSS 181, attached to chaetopterid worm tubes. F52009 (text-figs 57, 58) conical, 2×2.5 cm wide at base, 2 cm high. Specimens from station KG 6 larger, cushion-shaped, F52012 $8 \times 11 \times 2$ cm, F52013 $6 \times 8 \times 2$ cm. Dendy's specimens more massive and larger than new ones, often irregularly lobate. Lobes often compressed and convoluted, partly concrescent, distally separated by meandering fissures (pl. 10 fig. 6). Syntype of *Tedania rubicunda* Lendenfeld in Sydney (pl. 10 fig. 7) also of this type.

In life, bright orange to deep vermilion on surface, light orange-brown internally. Surface in life 2.5 YR 7/12 to 5 YR 7-8/12 in F52012, 10 R - 2.5 YR 7/12 in F52013. In drying, some areas of surface turn dark greenish grey. Softly rubbery, a bit limp, to moderately firm but compressible.

Surface in life smooth to vaguely verrucose and rugose. Common pattern of subdermal crypts set off by darker, greyish colour. Out of water, pattern accentuated in relief by receding dermis, more so in preserved specimens. Crowded polygonal pits surrounded by reticulate rugae, passing into meandrine, cerebroid pattern. Widths of depressions and rugae 0.4-0.8 mm. Dermis over depressions riddled by ostia, some barely visible optically. Flat specimens (F52012, pl. 10 fig. 3; F52013) have fine regular radial striation along parts of margin, as do specimens with compressed, erect lobes, then longitudinally below apices.

Oscules often slightly raised, irregularly scattered to clustered in flat specimens, more regularly on apices of rounded lobes, numerous on edges of compressed lobes. Width 1-5 mm; rim sharp, mostly irregular and sinuous, often composite, with confluent shallow atria, with mouths of exhalant canals between ridged partitions.

Choanosome conspicuously cavernous (text-figs 58, 60). Principal exhalant canals predominantly terete, straight, perpendicular to surface, 1-4 mm wide. Some branch and anastomose. Often folded to septate transversely, lining distinct, with clusters of apophyses. Inhalant canals 200-500 μ m wide, regularly arranged radially in peripheral choano-

some, in palisade-like pattern, particularly in massive specimens. Some locally arranged tangentially, corresponding to striation noted above. F52011 (text-fig. 61) contains much sand in choanosome, also eggs or embryos, deep red in life.

Main skeleton an irregular reticulation of pale, clear spongin fibres, cored (thinner ones) or packed by styles. Fibres straight to flexuous, 18 to 90 μm thick, branching and obliquely anastomosing with little order. Meshsizes 40 to 350 μm . Interstitial megascleres (thin styles, tylotes and onychaetes) irregularly scattered to crowded, occasionally obscuring meshwork. In some areas, interstitial megascleres, single or in pairs, take part in meshwork as anastomoses. Ectosome about 350 μm thick, with umbellar, dendritic or feathery arrangement of tylotes. Median branches and stems of umbels occasionally recurved, festooned.

Spiculation: (1) Styles, occasionally oxea, 120–171–203 \times 1.1–3.2–6.5 μm (144–166–188 \times 1.1–2.0–2.9 μm in F51939). (2) Tylotes with few distal spines, immature ones (in choanosome) almost strongyles, 158–202–239 \times 1.5–2.7–5 μm (169–185–213 \times 1.5–1.9–2.3 μm in F51939). (3) Faintly sculptured onychaetes, 69–125–168 \times 0.9–1.8 μm .

Remarks. The new material studied here differs from specimens of *T. ignis* (Duchassaing and Michelotti, see Wiedenmayer, 1977a: 133; van Soest, 1984: 49) primarily by the lack of dermal specialisation (tangentially strewn tylotes and onychaetes in *T. ignis*), and by the presence of a peripheral "palisade" of inhalant canals (not mentioned by van Soest, nor noticed by me in Bahamian specimens). The spicules in the new specimens from Bass Strait are generally shorter than in *T. ignis* (Wiedenmayer, 1977a: styles, 217–242 \times 4–6 μm ; tylotes, 220–246 \times 2.5–4 μm ; onychaetes, 40–220 μm ; van Soest, 1984: styles, 202–281 \times 4–9 μm ; tylotes, 180–248 \times 2.5–4.5 μm ; onychaetes in 2 sizes, 30–95 μm and 154–247 μm) and agree with Dendy's measurements for *T. digitata* from the Indian Ocean (1922: 100: styles, 200 \times 6 μm ; tylotes, 200 \times 4 μm ; onychaetes, 140 μm). Such differences are not meaningful on the species level. Measurements cited by Pulitzer-Finali (1978, 1983) for specimens from the western Mediterranean (styles, 205–280 \times 4.5–11 μm ; tylotes, 185–270 \times 2.3–4 μm ; onychaetes, 60–190 μm) are very similar to those of *T. ignis*.

The colour variants of *T. anhelans* other than red and orange, noted in the diagnosis above, apply chiefly to Mediterranean records, and have been recorded only sporadically from the Indo-Pacific region. Red to orange is remarkably constant in *T.*

ignis (Hechtel, 1965: 38). The appearance of dark greenish grey patches upon exposure to air of Bass Strait specimens may point to subtle chemical changes, which in Mediterranean populations are more easily developed in life. I recall, in this context, the greenish olive-drab hue noted by me (Wiedenmayer, 1977a: 133) in the fresh peripheral choanosome of *T. ignis*. Tangential dermal tylotes and detachable dermis have been observed in Mediterranean specimens by Schmidt (1868: 28) in his description of *Reniera muggiana*. The wide ecological affinities in all three biogeographic groups are very similar: typical members of the fouling community (e.g. Dendy's specimens from Sorrento and Queenscliff, harbours inside Port Phillip Heads), occasionally extending to slightly brackish water (mangrove community for *T. ignis*; Schmidt's capriciously shaped types of *R. digitata* from Venice), but also found on a variety of rocky to muddy substrates of the Mediterranean (1–70 m fide Boury-Esnault, 1971; Pulitzer-Finali, 1978: 1983).

The variability in sculpture of onychaetes in *T. anhelans* (as *digitata*), from almost smooth to spinulate, has been discussed by Topsent (1897: 454) and Lundbeck (1910: 5). Lindgren's (1898: record of *T. digitata* is here treated with reserve because of the exceptionally large spicules (styles, 300 \times 16 μm ; tylotes, 240 \times 6 μm ; onychaetes almost hastate, 336 \times 5 μm). In conclusion, van Soest's remark (1984: 52) is still valid, that large series of specimens of this species complex from different parts of the world need to be examined before such distinctions are meaningful. *Tedania commixta* Ridley and Dendy (1886: 335; 1887: 52), originally described from Moncoeur Island, Bass Strait, 70 m, recorded again by Dendy (1895: 258) from Port Phillip Heads, seems to be a good species. Topsent (1904: 176) recorded it from the Azores (98 m, gravel, sand, broken shells). It is distinct by its creamy yellow surface, consistently high content of foreign inclusions, and subtylotes without distal spines. Both styles (300–400 \times 4–6 μm) and subtylotes (325–350 \times 3–4 μm) are longer than in *T. anhelans*, and comparatively slender.

Forcepia Carter

Forcepia Carter, 1874: 248, pl. 15 fig. 47. — Topsent, 1904: 177 (definition, review). — Lundbeck, 1905: 19 (discussion), 198 (definition), 210 (discussion, review). — Dendy, 1922: 91 (definition, discussion). — Van Soest, 1984: 66 (definition, *Ectoforcepia* as subgenus), 69 (discussion).

Ectoforcepia Cabioch, 1968: 232. — Boury-Esnault, 1973: 280. — Van Soest, 1984: 66, 69.

Diagnosis. "[Tedaniidae] with choanosomal monactinal or diactinal (tylote) megascleres and smooth and/or acanthose forcipes, isochelae and sigmata as microscleres." (Van Soest, 1984: 66.) Sigmata may be absent. Choanosomal styles may be smooth or spined.

Remarks. The only diagnostic trait separating the two subgenera, according to van Soest, is the presence/absence of styles. This subdivision, although probably desirable, is here avoided for a nomenclatorial reason: *Forcepia colonensis* Carter, as type species of *Forcepia*, would automatically be the type species of the nominotypical subgenus. This West Indian species, however, is only known from isolated large acanthose forcipes, and its placement in either subgenus would be conjectural. Van Soest (1984: 66) pointed out that the same type of forcipes occurs in a West Indian sponge, described by him as *Forcepia (Ectoforcepia) trilabis* Boury-Esnault, but that synonymy was uncertain.

Forcepia biceps (Carter)

Plate 10 figures 8–11, plate 30 figure 2,
text-figure 63

Forcepia colonensis. —Carter, 1885a: 110, pl. 4 fig. 2 (Port Phillip Heads, Vic.). —Carter, 1886a: 53 (old record). —Dendy, 1896: 24 (outside Port Phillip Heads; synonymised with *Suberites biceps* Carter). —Lundbeck, 1905: 210 (in discussion: Australian record distinct, possibly not in *Forcepia*).

nec *Forcepia colonensis* Carter, 1874: 248, pl. 15 fig. 47 (Colón, Panama; isolated forcipes from sediment).

Suberites biceps Carter, 1886b: 117 (Port Phillip Heads).

Forcepia michaelsoni Hentschel, 1911: 336, 337, text-fig. 27 (for *Forcepia colonensis*: Carter, 1885; Rottneet Island, WA).

Material examined. One specimen, station KG 6 (F52018). Holotype of *Suberites biceps* (BMNH). Hypotypes of *Forcepia colonensis*: Carter, 1885a (BMNH), Dendy, 1896 (NMV).

Diagnosis. Cushion-shaped to irregularly massive, lobate. Lobes marginal and apical, tending to be conical. Firmly rubbery, easily torn, slimy in life. Surface deep red, internally pale red-orange in life. Surface partly smooth, glabrous, partly wrinkled in parallel, radial and reticulate patterns. Oscules clustered, sieve-like, on lobes. Vestibules conspicuous, numerous, radial, in palisade-like peripheral zone about 5 mm deep. Ectosome mostly thin, up to 1 mm, contains reticulum of paratangential tylotes. inner choanosome cavernous, bread-like. Main skeleton of tylotes only, in vague reticulation, with ascending tracts commonly better developed, frequently obscured by megascleres in confusion.

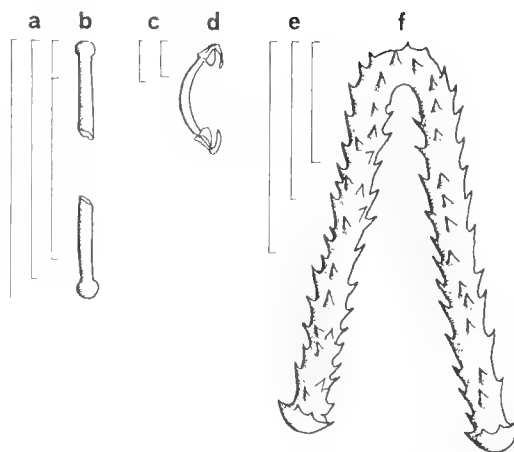


Figure 63. *Forcepia biceps*, spicules. a. Range of tylotes, $\times 68$. b. Enlarged ends of tylote, $\times 263$. c–d. Arcuate isochelae: c, range, $\times 263$; d, example, $\times 790$. e. Range of forcipes, $\times 263$. f. Enlarged forcipes, $\times 788$.

No styles. Forcipes spined, massive, with curved apex. Arcuate isochelae, no sigmata.

Description. Cushion-shaped, with sinuous outline and pinched marginal lobes, some upturned; 11 \times 15 cm in width, 3 cm in height.

In life deep red on the surface (7.5 R 5–6/12), paler, more orange in choanosome; now beige with yellowish and greyish tinges. Firmly rubbery, easily torn, slimy in life. Mucus preserved in alcohol as flaky to stringy sediment.

Surface partly smooth, glabrous, partly wrinkled. Wrinkles locally radial, or in vaguely rugoreticulate to cerebriform pattern. Oscules small, 1–2 mm wide, in sieve-like groups on marginal lobes. On surface not covered by encrusting and branching algae, fine ostia virtually ubiquitous, conspicuous only in dendritic depressions, chiefly around margin, often clustering in interstices of fine dermal reticulum over subdermal spaces.

Choanosome riddled by exhalant canals, straight, terete, 1–3 mm wide, tangential and perpendicular to surface. They bear widely spaced annular sphincters. Subdermal crypts radial, in palisade-like zone about 5 mm deep, with sparse anastomoses. Numerous embryos, deep red in life. Main skeleton of tylotes in sinuous to angular tracts of variable thickness (45–175 μm) and spacing, infrequently branching and merging with oblique anastomoses of single spicules or loose fascicles. Structure frequently obscured by megascleres in confusion.

Ectosome often thin, comprising vague reticulum of paratangential tylotes over spaces traversed by umbellar ends of main tracts, but up to 1 mm

thick, with tylotes packed in confusion around irregular alveoles.

Spiculation: (1) Tylotes, mostly somewhat flexuous, terete to slightly fusiform, with distinct spherical heads, length 393–431–467 μm ; width of shaft, 5.6–10.6 μm ; width of tyles, 9.4–13.5 μm . (2) Arcuate isochela, 16.4–19 \times 5.4–7.5 μm . (3) Acanthose forceps with slightly waisted apex and gently outward-curved, divergent capped arms, length 56–73–98 μm ; total width, 25–29–49 μm ; proximal width of arms, 5–6–7.1 μm .

Remarks. Of the other two congeners known from southern Australia, *F. crassanchorata* Carter (1885a: 111, pl. 4 fig. 3; known only from a dry specimen from Port Elliot, SA) has often subtylote styles next to tylotes; small, frail, faintly spined forceps with almost pointed apex and straight, little diverging arms; isochelae of two sizes: (1) stout, with strongly arched, dorso-ventrally compressed shaft, (2) much smaller, frail, normal shape; frail, parabolic sigmata. *Forcepia carteri* Dendy (1896) is thoroughly sandy, and has proper spicules only at the surface. These are only forceps and stout chelae, both similar to those in *F. crassanchorata*, but the chelae have only half the size of the larger ones in Carter's species.

Lissodendoryx Topsent

Lissodendoryx Topsent, 1892a: 63, 96, 97. — Lundbeck, 1905: 153 (definition, discussion). — Wiedenmayer, 1977a: 135 (references). — Van Soest, 1984: 54 (definition), 59 (discussion).

Dendoricella Lundbeck, 1905: 126 (type species: *D. rhophum* Lundbeck, 1905, by subsequent designation in de Laubenfels, 1936a: 53). — Topsent, 1928: 52 (in review of Myxillinae).

Paramyxilla Dendy, 1905: 233 (in footnote; type species: *Halichondria frequens* Carter, 1881a, by monotypy). — Topsent, 1928: 53 (synonymised with *Dendoricella*).

Hamigera sensu Dendy, 1922: 90. — nec *Hamigera* Gray, 1867a: 536.

Damiriella Burton, 1935: 404 (type species: *Damiria cavernosa* Topsent, 1892c: xxii). — Pulitzer-Finali, 1978: 56 (type species redescribed). — Van Soest, 1984: 60 (discussion).

Jones de Laubenfels, 1936a: 79 (type species: *Myxilla amaknakensis* Lambe, 1894, by original designation and monotypy). — Bakus, 1966: 499, 513 (synonymised with *Lissodendoryx*).

Merriamium sensu de Laubenfels, 1936a: 83 (part: not type species *M. tortugasense* de Laubenfels, 1936a). — de Laubenfels, 1939: 4 (part, not *M. roosevelti*).

?*Waldoschmittia* de Laubenfels, 1936a: 95 (type species: *Crella schmidtii* Ridley, 1884a, by original designation).

Zetekispongia de Laubenfels, 1936b: 446 (type species: *Z. zonea* de Laubenfels, 1936b, by original designation

and monotypy). — Van Soest, 1984: 60 (type species re-examined, synonymised with *Lissodendoryx*).

Damiriana de Laubenfels, 1950a: 13 (type species: *D. hawaiiiana* de Laubenfels, 1950a, by monotypy).

Diagnosis. “[Tedaniidae] with monactinal or diactinal, smooth or acanthose choanosome megascleres arranged in a renieroid [subisodictyal] reticulation of single spicules [or bundles]; microscleres always include arcuate isochelae and sigmata.” (Van Soest, 1984: 54). Sigmata may be absent. Longer tracts, sometimes dendritic, may be present. The arcuate chela is the only real distinction from *Myxilla*, which always has anchorate chelae.

Remarks. In his revision and discussion of *Lissodendoryx*, van Soest (1984) emphasised reticulate skeletal structure, tylote ectosomal spicules, and arcuate chelae and sigmata as microscleres. The stylote versus diactinal morphology of choanosomal megascleres is dismissed as having little significance. This is based chiefly on choanosomal strongyles in his *L. strongylata* and on the undifferentiated tylotes in the choanosome of *L. sigmata* (de Laubenfels). In consequence, van Soest also included species with choanosomal oxea (*Zetekispongia*) in *Lissodendoryx*. I concur with the inclusion of the two West-Indian species described by van Soest next to *L. isodictyalis*, as I have previously (Wiedenmayer, 1977a: 137) interpreted mucronate modifications of tylotes in *L. sigmata* as transitional to some types of subtylostyles found in *L. isodictyalis*.

More meaningful is the occurrence of choanosomal strongyles and oxea in Myxillinae from other parts of the world, several of which have been misplaced (in the wrong genus) in the past. I should stress, before the following review, that I follow Topsent's diagnostic treatment of the Myxillinae (Tedaniidae with chelae), except for dropping the distinction diactinal/monactinal choanosomal megascleres. The basic distinction, adopted by Topsent and most other systematists (except Dendy in his later work), of forms with arcuate chelae versus forms with anchorate chelae, was introduced by Lundbeck (1905). The only difficulty here is the exception in *Myxilla? decepta* Kirkpatrick (see Koltun, 1964: 52), which has both sorts of chelae. As will be justified below, I do not regard sigmata mandatory in diagnosing *Lissodendoryx*, thus also following Lundbeck (1905) and Topsent (1928).

The genera in question, which need clarification, are:

(1) *Dendoricella* Lundbeck. The type species, *D. rhophum*, has the spiculation and skeletal struc-

ture of *Lissodendoryx* (without sigmata). The only significant diagnostic trait of this genus, for Lundbeck, was exclusive presence of oxea or strongyles in the choanosome. De Laubenfels (1936a: 53) was mistaken in characterising this genus with the presence of "odd spiny palmate" isochelae. Only in *D. rhopalum*, and here only in one specimen known, are odd arcuate chelae dominant, in which the compressed shaft bears a high, thin dorsal keel, which may be again modified, in few chelae, by being little lobate. In most specimens, weakly keeled modifications are subdominant to equally frequent with more normal types having lightly compressed shafts. The only peculiarity (but only diagnostic for this species) is the acuminate shape of the alae. Otherwise these are clearly arcuate chelae, lacking the proximally separate lateral alae and the fimbriae of anchorate chelae. (Incidentally, a separate new genus for Myxillinae with odd spiny chelae would be more justified for *Myxilla insolens* Koltun (1964: 52, text-fig. 11).) Of the other species included by Lundbeck, *Crella schmidtii* Ridley is the type species of *Waldoschmittia* (see *Damiriana*, below). *Damiria cavernosa* Topsent is the type species of *Damiriella* (see below). *Desmacidon abyssi* Topsent (1904: 204) has unguiferous chelae (without fimbriae) according to Topsent's figure, and is probably a *Myxilla*. *Dendoricella obesichela* Lundbeck (the last included species, known only from a fragment) is similar to *D. rhopalum* in having oxea in choanosome and dermis, but has normal (stout) arcuate chelae and sigmata. It is thus close to *Zetekispongia zona* (which has dermal tylotes). In conclusion, I see no grounds for separating *Dendoricella* from *Lissodendoryx*.

(2) *Paramyxilla* Dendy. The type species has choanosomal acanthoxea. I follow Topsent in synonymising this with *Dendoricella* (and thus with *Lissodendoryx*), in analogy with the spicular vicariance of smooth/acanthose choanosomal styles in Myxillinae.

(3) *Damiriella* Burton (1935: 401; type species by monotypy: *Damiria cavernosa* Topsent, 1892c: xxii). Van Soest (1984: 60) mentioned this as being close to *Lissodendoryx*, but lacking sigmata. The type species, from Banyuls, has only been briefly diagnosed by Topsent (1892c), as having choanosomal strongyles, dermal tylotes, and small isochelae with curved shaft, and pectinate (comb-shaped) ends ("a bouts pectinés"). The latter statement was unclear to Lundbeck (1905); Burton (1935), in his generic diagnosis, interpreted it as unguiferous (pluridentate?) isochelae. It was redescribed in detail, from fresh material, by Topsent (1936a: 19, fig. 4), as *Lyssodendoryx caver-*

nosa, with most "strongyles" being styloids (one end manubriate, the other mucronate), a few with residual spination. The chelae are said to be arcuate chelae of two sizes. While this is no doubt true for the large kind, the small one is like a pluridentate unguiferous chela with c-shaped, smooth shaft. Topsent correctly compares it with the peculiar small "chela" of *Lissodendoryx indistincta* (see Lundbeck, 1905: 162, pl. 16 figs. 3 f, g). This differs from the one in *L. cavernosa* only in having thin, finely lobate rims along both sides of the shaft. Both have minute teeth barely visible in smallest examples. Dendy (1921: 119, fig. 31) compared the one in *L. indistincta* with the dentate sigmaspires in some spirophorids (*Craniella disigma* and *Chrotella amphiacantha* Topsent, 1904). I doubt that these types are homologous, but I agree with Dendy that those in *Lissodendoryx* are neither true chelae nor sigmata. It is significant that the boreal sibling species, *L. indistincta*, has true sigmata and normal choanosomal styles varying from smooth to weakly spined. The specimens described by Pulitzer-Finali (1978: 56) have as choanosomal megascleres chiefly asymmetrical strongyles, with one or both ends slightly swollen. The species was recorded again by Pulitzer-Finali (1983: 560). *Lissodendoryx cavernosa* in Rützler (1965: 31) is doubtful, as he mentions only acanthostyles in the choanosome. On the other hand, his sponge identified as *Lissodendoryx isodictyalis*, from its ecology and packing with fine gravel, might be *cavernosa*, though it was whitish in life (*L. cavernosa* was described as yellow by Topsent, 1936a, and by Pulitzer-Finali, 1983), and Rützler mentioned anchorate chelae ("Isancora").

(4) *Jones*. The type species differs from other Myxillinae in having sparsely spined oxea as dermal megascleres. De Laubenfels therefore included the "genus" in the Crellidae. It is otherwise like *Lissodendoryx* (see also Koltun, 1959: 135).

(5) *Merriamium*. De Laubenfels apparently intended this genus chiefly to include "atypical" species of *Lissodendoryx* and *Ectyodoryx* (he assigned the "typical" species to the "Tedaniidae" and "Myxillidae", respectively) lacking sigmata. The type species, the West-Indian *M. tortugasense* (ending here emended to conform with de Laubenfels' (1939) use of the neuter gender with all other species included) is a junior synonym of *Phorbas amaranthus* Duchassaing and Michelotti, according to van Soest (1984: 86) who examined the holotypes of both species. *Merriamium* is thus a junior synonym of *Phorbas* (ex *Anchinioe*) in the Anchinoidea. *Hymeniacidon paupertas* Bowerbank has been placed in *Ectyodoryx* (Burton, 1932a: 313; followed by Koltun, 1964), *Hymedesmia* (Lundbeck, 1905:

113; Topsent, 1928: 57), and more recently, in *Anchinoe* (correctly *Phorbas*: Borojević et al., 1968: 23; Pulitzer-Finali, 1983: 564, 610). It is clear that the species does not belong in the Tedaniidae. *M. roosevelti*, the only species added by de Laubenfels (1939, review with key of the species included in 1936a), from the Galapagos, is only briefly described, microscopically only as to spiculation. It probably belongs to either Hymedesmiidae or Anchinoidae.

Of the remaining 12 species included, those eight with only one kind (size) of choanosomal megasclere should be left in *Lissodendoryx*: *L. sophia* and *L. lobosa* (see Lundbeck, 1905), *L. certa* (Topsent, 1892a), *L. mollis* (Lindgren, 1897; de Laubenfels' replacement name *lindgreni* is superfluous), *L. buehneri* Topsent (1913a), *L. lundbecki* Topsent (1913b; has signata according to the original description), *L. styloderma* Hentschel (1914), and *L. kyma* de Laubenfels (1930). Four species (*clavigera*, *atlantica*, *maculata*, *ramilobosa*) should be left in *Ectyodoryx*.

(6) *Zetekispongia* de Laubenfels differs from typical *Lissodendoryx* by possessing oxea only as choanosomal megascleres.

(7) *Damiriana* de Laubenfels. The type species, according to the original description and text-figure 7D, has arcuate chelae of two sizes. It is probably synonymous with *Zetekispongia zonea*. According to Topsent (1897) and Burton (1935), *Damiria australiensis* Dendy (1896) is a junior synonym of *Crella schmidtii* Ridley (1884a: 432). Lévi (1958: 30) synonymised *Damiria australiensis* Dendy, 1896, *Damiria schmidtii*: Topsent, 1897, *Damiria australiensis*: Lindgren, 1897, 1898, *Dendoricella schmidtii*: Hentschel, 1912, and Dendy and Frederick, 1924, and *Damiriana hawaiiiana* de Laubenfels with *Crella schmidtii* Ridley, and described a sponge from the Red Sea as *Damiriana schmidtii* (Ridley) (again in Lévi, 1965a: 16). He was followed by Tsurumai (1969: 153), Desqueyroux-Faundez (1981: 741), and Pulitzer-Finali (1983: 609). According to this view, the single species would be widely distributed (Australia, Indo-Malayan province, Red Sea, eastern Mediterranean) and characterised by dermal tylotes, choanosomal oxea, arcuate chelae, and signata, all of variable dimensions. Van Soest (1984) regarded *Damiriana* as a probable synonym of *Lissodendoryx*.

The nature of the chela in *Crella schmidtii* is not clear from the original description, nor from those of Dendy (1896), Topsent (1897), and Thiele (1903a: 954, who mentioned "tridentate isochelae" of 2 sizes). Ridley's figure (1884a, pl. 41, fig. aa) could be interpreted as representing an anchorate chela. The relevant figures in Lindgren (1898, pl.

19, figs 15c, c') are ambiguous, but that in Desqueyroux-Faundez (1982, fig. 42), based on one of Topsent's four specimens, clearly shows a tridentate anchorate chela, deviating from the usual shape only by the forward inclination of the lateral teeth. The descriptions and figures of isochelae in Lévi (1958, fig. 25; 1965a, fig. 17), and Tsurumai (1969, pl. 2, fig. 4) refer to the arcuate type. There is a distinct possibility that two species and two genera are involved in this complex. This should be settled by re-examination of the older material, particularly that of *Crella schmidtii* Ridley. If the latter should turn out to possess anchorate chelae, *Waldoschmittia* would be available for it and any other records with such chelae. This genus name, however, would ultimately fall in synonymy to *Myxilla*, since the case would be exactly parallel to *Lissodendoryx/Damiriana*.

The presence of diactines or monactines in the choanosome of Myxillinae can be interpreted as homology of the two basic types, more commonly expressed as an interspecific spicular vicariance, occasionally with both types present within one species, then commonly in individually variable proportions (e.g. acanthostrongyles next to acanthostyles in *Myxilla brunnea*, *Stelodoryx flabellum*, see Koltun, 1959). The spicular vicariance probably extends to the differentiation of ectosomal megascleres. It is expressed in the frequently similar dimensions, occasionally in the morphological similarity or even identity of choanosomal and ectosomal megascleres. Hereby, the rule seems to be invasion of the choanosome by ectosomal megascleres, and by the virtual or total expulsion of typical choanosomal types. Total invasion of the choanosome by tylotes is the case in the West-Indian *L. signata* (de Laubenfels), virtual expulsion of choanosomal styles exists in *L. dendyi* (Shaw, see end of Remarks on *L. isodictyalis*, below). It is unlikely that the Antarctic *L. styloderma* represents an inversed trend (invasion of the ectosome by choanosomal styles), as choanosomal styles in this species are distinctly larger and are frequently modified as subtylostyles. This spicular vicariance is corroborated by the variable proportion of asymmetrical and even stylote modifications of dermal diacts in several species (e.g. *Lissodendoryx lundbecki*, *L. diversichela*, *L. fragilis*, *L. stipitata*, see Koltun, 1959). A parallel is seen in *Tedania*: occasionally oxea are present in the choanosome of *T. anhelans* from Bass Strait (as noted above); in *T. oxecta* Topsent (see Koltun, 1964, 1966a), choanosomal styles are completely replaced by oxea. In the latter species, dermal megascleres are also oxea, but decidedly smaller and verging on tornotes. Another, more distant

parallel, regarding choanosomal megascleres, may be seen in Axinellida, e.g. in *Trachycladus laevispirulifer*, described above.

The case is not always clear-cut in *Lissodendoryx*: choanosomal strongyles may be slightly asymmetrical, as in *L. cavernosa* (see above) and in *L. buchanani* Topsent (1913a). A parallel spicular vicariance is the better known one of spiny versus smooth choanosomal styles. The presence of either acanthose or smooth styles has been used to segregate *Myxilla* and *Lissodendoryx*, respectively, last by Dendy (1922: 88, 90, with *Hamigera* used as a senior synonym of *Lissodendoryx*). He rejected the presence of either anchorate or arcuate chelae as a diagnostic criterion (referring to both as "tridentate isochelae") on the ground that they are indifferent in phylogeny (see also Dendy, 1921: 112f., 144). Lundbeck (1905) has shown that interspecific spicular vicariance of smooth/acanthose choanosomal styles is common in boreal species of *Lissodendoryx*, and that some species (*L. fragilis*, *L. indistincta*) combine both types in variable proportions, with transitions. Dendy (1922: 90) acknowledged the difficulty with his system, but retained a distinction of the two genera (*Myxilla* and *Lissodendoryx*) for a practical purpose. Several species of *Myxilla* with smooth styles are known (Dendy, 1924: 362). Lundbeck's diagnostic emphasis on chelae types has been followed by most systematists, especially by Topsent (1928: 52f.) in his influential synopsis of Myxillinae. In *L. firma* (Lambe) from the west coast of North America, as redescribed by Bakus (1966: 487), smooth and sparsely spined styles of similar size occur in the choanosome in variable proportions between specimens, often almost mutually exclusive. Spicular tracts occur in the peripheral choanosome, cored and "very crudely echinated" by the same styles or acanthostyles. In *L. kyma* de Laubenfels (1932: 75; see also Bakus, 1966: 491), another species from the west coast of North America, lacking sigmata, the main skeleton is similar, but there is an imperfect (intraspecifically variable) segregation of styles by size, small ones having a spined base. Dendy (1922: 88), in his diagnosis of *Myxilla*, stated that some acanthostyles in the main skeleton may be echinating. Equally important to chelae types, as diagnostic criterion for genera of Myxillinae, when Topsent's system of 1928 is maintained, is the consistent presence of two sorts of choanosomal megascleres in some genera, particularly when distinguished not only by morphology, but by size, and by location (interstitial and/or echinating auxiliary megascleres, the latter in *Ectyodoryx*, *Ectyomyxilla*, *Chaetodoryx*, "*Onychomyxilla*" (superfluous), and *Iophon*. The inclusion of *Lis-*

sodendoryx jacksoniana (Lendenfeld, 1888, with small strongyles next to the normal styles in the choanosome) in this genus should be reconsidered, in favour of a new genus, distinct from *Chaetodoryx* by the lack of echinating acanthostyles. I do not think that the interstitial "oxychaetes" of the type species of the latter (*C. richardi* Topsent, 1927, see Topsent, 1928: 242; by monotypy) are really distinct from the onychaetes of the Tedaniinae. Their size ($225\text{--}245 \times 2\text{--}3 \mu\text{m}$) is well below that of the largest onychaetes in *Tedania* (up to $760 \times 4.5 \mu\text{m}$ in *T. tantula* (Kirkpatrick) fide Koltun, 1964: 59). Since some onychaetes are smooth, others almost tornote, their homology with the small interstitial strongyles of "*L.*" *jacksoniana* is likely.

These considerations lead to the case of *Hamigera* Gray. The genus is still monotypic, with the type species *Cribrella hamigera* Schmidt (1862, cited by Gray as *Hamigera rubens* because of his aversion to tautonymy). Its spiculation corresponds to that of *Lissodendoryx* without sigmata. There are basically two views on its skeletal structure and systematic position:

(1) Thiele (1903a: 353) and Dendy (1922: 90). Both saw a "myxillid" affinity of *Hamigera*. Thiele, who examined a schizotype of *Cribrella hamigera* Schmidt, thought that it was a "myxillid" with an irregular, chiefly dendritic main skeleton with mingled diactines and monactines, distinct from *Myxilla* and *Lissodendoryx*, to which he attributed a regular, subisodictyal main skeleton of monactines only. His attribution of *ternatensis* (a synonym of *isodictyalis*) to *Hamigera* was probably motivated by excessive reliance on the peripheral choanosome (he examined only slides and a small fragment in paraffin, left by Kieschnick), where dendritic tracts with mixed megascleres are indeed common, but not exclusive to all peripheries of *L. isodictyalis*. Dendy did not mention Thiele's conclusions (nor Lundbeck's, see below), and relied solely on Schmidt's unsatisfactory description of *C. hamigera*. He bluntly accepted *Hamigera* as senior synonym of *Lissodendoryx*.

(2) Topsent (1892a: 102) and Lundbeck (1905: 173) regarded *C. hamigera* Schmidt not as a tedaniid, but as an "ectyonine" related to *Echinodictyum*. Topsent then relied on fresh material from Bonifacio, Corsica, and noticed that all tracts of the main skeleton are constituted by diacts (strongyles) and are echinated by smooth subtylostyles (a disposition negated by Thiele, 1903a). (Schmidt's figure and description of the chelae as unguiferate, like those of *Myxilla veneta* [a junior synonym of *Plumohalichondria plumosa*, fide Vosmaer, 1932–1935: 260, 265] is obviously based on faulty observation of a microscle type

then new, in which he saw only the falces, not the alae.) Lundbeck (1905) examined another schizotype of *C. hamigera*, and found Topsent's observation confirmed. Topsent (1928: 571.) reaffirmed the affinity of *Hamigera* with *Echinodictyum* (the latter is now placed in the Raspailiidae) and the Anchinoidae. The latter familial assignment is maintained more recently by Boury-Esnault (1971: 322), Lévi in Brien et al. (1973: 613), and Pulitzer-Finali (1983: 566) for *Hamigera*.

Hamigera is aberrant within the Anchinoidae in having columnar spiculofibres cored by smooth strongyles, echinated by smooth subtylostyles. Plumose columns of acanthostyles, often echinated by smaller acanthostyles, are the rule in the Anchinoidae.

As I have expressed in my addition to van Soest's diagnosis of *Lissodendoryx*, this author has placed too much emphasis (also in his diagnosis of the Tedaniidae) on reticulate structure of the main skeleton. Short dendritic portions occur in the main skeleton (chiefly peripheral) of some massive *Lissodendoryx* (and of *Tedania*, as noted above), but in some stipitate and ramose species (*L. stipitata* Lundbeck, 1905: 170, see also Koltun, 1959: 133; *L. buehanani* Topsent, 1913a: 626) the dendritic style is more pervasive, though commonly supplemented by interstitial single spicules of the same kind. A parallel situation exists within *Myxilla* (see diagnosis in Lundbeck, 1905: 131; Topsent, 1913a: 626), so that *Stelodoryx* is probably a synonym of *Myxilla* (pluridentate versus tridentate chelae not being a reliable criterion).

Hamigera can be regarded as a borderline case between Tedaniidae and Anchinoidae. Van Soest (1984: 71, 89) commented on other affinities between the group *Myxilla*, *Ectyomyxilla* and *Ectyodoryx* (*Myxillinae* sensu van Soest) in the former, and *Plumohalichondria* in the latter (cited as *Pronax* Gray, and thus mistakenly used by several modern authors: this is a junior homonym, as de Laubenfels, 1936a: 63, pointed out, with the usual superfluous replacement name *Grayax*). But van Soest only pointed to similarity in spiculation; the presence of auxiliary, mostly echinating acanthostyles in *Ectyodoryx*, and in other myxillines mentioned above, is more relevant. Incidentally, I find van Soest's criterium insufficient, for maintaining the subfamilies Myxillinae and Tedaniinae (not in Topsent's sense) for groups with tylote versus oxeote or strongylote ectosomal megascleres, respectively. Some such megascleres in *Myxilla* (though indiscriminately called tornotes by Koltun) are tylotes and their spined or mucronate modifications, while corresponding spicules in *Lissodendoryx* are often oxeote (see Lundbeck, 1905;

Koltun, 1959). It should also be noted that such megascleres in both genera are frequently asymmetrical, sometimes stylote (see above).

I cannot accept van Soest's insistence on sigmata always being present in *Lissodendoryx*. There is a number of species with the usual traits of *Lissodendoryx* but lacking sigmata. In addition to those cited above, under *Merriamium*, there are the following boreal and N. Pacific species (see Koltun, 1959): *L. behringi* Koltun, *L. papillosa* Koltun, *L. amaknakensis* (Lambe), and *L. ivanovi* Koltun ("*Lissodendoryx*" *oxeota* Koltun seems to have unguiferate chelae and may be a *Myxilla*); plus the Antarctic *L. flabellata* Burton (1929a). The variables in morphology and arrangement of megascleres mentioned above (monactinal/diactinal and regularly/irregularly spined/smooth choanosomal spicules; tylote/strongylote/oxeote/stylote dermal spicules; presence/absence of dendritic tracts and semi-plumose columns) occur in the genus regardless of presence/absence of sigmata. The sibling pair *L. indistincta* - *L. cavernosa* is especially instructive in this context. A further point is that no systematist, to my knowledge, has consistently maintained a generic separation of asigmatate species of *Myxilla* (see review in Dendy, 1924: 362), of *Forcepia* (see above), and of *Ectyodoryx*. The partial exception is de Laubenfels' unsuccessful attempt with *Merriamium*.

Lissodendoryx isodictyalis (Carter)

Plate 10 figure 12a, b, plate 11 figures 1, 2,
plate 30 figure 3, text-figure 64

Selected synonymy.

Halichondria isodictyalis Carter, 1882b: 285, pl. 11 figs 2a-e (Venezuela, Bahamas, Pacific coast of Mexico). — Carter, 1886a: 52 (Port Phillip Bay).

Myxilla isodictyalis. — Dendy, 1896: 30 (Port Phillip Bay). — Whitelegge, 1901: 79 (Tuggerah Beach, NSW).

Lissodendoryx isodictyalis. — Topsent, 1897: 456 (Indonesia). — Topsent, 1925a: 701 (Naples, Monaco; comparative spicule measurements). — Topsent, 1936a: 18 (discussion). — Hechtel, 1965: 38 (Jamaica; comprehensive synonymy, description, distribution, discussion). — ?Rützler, 1965: 31 (N. Yugoslavia; description, ecology). — Wiedenmayer 1977a: 135, text-figs 141, 142, pl. 29 fig. 2 (Bahamas; further references, type data, description, ecology). — Thomas, 1973b: 31, pl. 2 fig. 3 (Mahe, Seychelles). — Bergquist and Sinclair, 1973: 38 (New Zealand; larval ecology). — Van Soest, 1984: 54, text-fig. 19, pl. 5 figs 2, 3 (West Indies; further synonyms, description, discussion, distribution).

Lissodendoryx similis Thiele, 1899: 18, pl. 5 fig. 10 (Indonesia). — Burton and Rao, 1932: 331 (Burma). — Ali, 1956a: 293 (Madras harbour). — Ali, 1956b: 553 (Madras harbour; ontogeny).

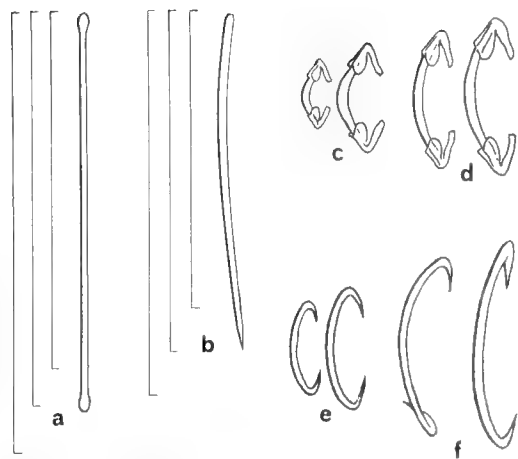


Figure 64. *Lissodendoryx isodictyalis*, spicules. a. Range and example of tylotes, $\times 263$. b. Range and example of styles, $\times 263$. c. Range of small chelae, $\times 788$. d. Range of large chelae, $\times 788$. e. Range of small sigmata, $\times 788$. f. Range of large sigmata, $\times 788$.

Hamigera ternatensis Thiele, 1903a: 952, fig. 18 (Indonesia).

Lissodendoryx ternatensis.—Lundbeck, 1905: 173 (transfer, discussion).—Burton and Rao, 1932: 331 (India).

Lissodendoryx sinensis Brøndsted, 1929: 228, text-fig. 5 (Formosa Strait, China).—Burton, 1937: 26, pl. 3 fig. 19 (retained, diagnosis).

Material examined. Station BSS 181, two adjacent specimens (F52019). Eight West-Indian syntypes of *Halichondria isodictyalis* Carter in Liverpool (see Wiedenmayer, 1977a: 135, 258). Living populations and 4 self-collected specimens, Bahamas (Wiedenmayer, 1977a: 135). Hypotypes of Dendy, 1896 (*Myxilla isodictyalis*, Port Phillip Heads and Sorrento jetty; NMV).

Diagnosis. Thinly encrusting to massive, lobate to digitate, rarely repent-ramose. Lobes commonly conical. Common in shallow water, fouling communities, often epibiotic on vegetation (mangrove roots, sea grass, algae) and various invertebrates. Softly spongy, very compressible, easily torn. Colour variable: often greenish, but also yellowish, brownish, greyish lavender, light purple. Oscules conspicuous, mostly apical on lobes. Surface smooth to finely papillate or rugose. Dermis thin, detachable, semidiaphanous over dendritic-vermiculate canals and punctiform vestibules, with numerous tylotes loose or in bundles, often reticulate. Microscleres may be crowded at surface.

Choanosome bread-like. Main skeleton irregular, vaguely reticulate, subsodictyal, with megascleres single or in bundles, with some longer, sinuous tracts, often masked by confused disposition. Abundance of microscleres in choanosome

variable. Spiculation within populations may be variable.

Description. Small, ovoid-compressed and bean-shaped, $20 \times 18 \times 12$ mm, and $30 \times 18 \times 10$ mm. Base of attachment narrow in small specimen, on most of broadside of larger one.

In life light olivaceous brown (10 YR 5-6/4), now light yellowish grey to beige (2.5 Y 7-8/2-4). Softly spongy, easily torn.

Surface smooth to finely sculptured. Relief a continuous pattern of vermiculate, dendritic subdermal canals, which occasionally anastomose. Canals 0.2-0.5 mm wide, slightly raised dense partitions 0.5-1 mm wide. Dermis over weak depressions contains fine reticulum with interstitial ostia.

More prominent oscules conical to irregularly lipped, 2-3 mm wide, angular, apical and single on smaller specimen, subapical and contiguous on larger one. Smaller oscules irregularly scattered on sides, some round, others sinuous, or as contorted fissures. Dermis detachable in flakes, with scattered sand grains. Choanosome dense, traversed by few irregular exhalant canals of angular section, or like fissures.

Ectosome not well defined, commonly finely cavernous; thickness variable, mostly around 260 μ m; contains thick fascicles of tylotes, subtangentially, obliquely or perpendicularly to surface. Surface crowded to packed with microscleres. Chelae concentrated in outer third to half of ectosome, sigmata equally numerous throughout. Main skeleton a subsodictyal reticulation of megascleres, singly or in bundles of up to 4-5 spicules. Occasional longer, sinuous tracts. Structure frequently obscured by confused arrangement. Megascleres mostly styles, fewer tylotes regularly scattered. Abundance of chelae in choanosome irregular, always greatest around canals.

Spiculation: (1) Tylotes, fusiform, mostly straight, with spherical to oblong tyles (tapering inward) frequently unequal in size and shape, $168-185-207 \times 2.5-2.9-3.4$ μ m. (2) Fusiform styles to styloids (anisoxea with blunt to pointed shorter ends), straight but more frequently bent at one-third from the base, $139-159-180 \times 2.6-3.3-3.8$ μ m. (3) Arcuate isochelae of two size ranges (smaller ones less numerous, with proportionately wider profile, more strongly arched): $22.2-23.3-24.9 \times 6.4-7.3-9.2$ μ m, (chord and profile width), and $12.4-15.1-18.1 \times 3.5-5.7-7.6$ μ m. (4) Sigmata of two imperfectly segregated size ranges, smaller ones less numerous, $29.3-30.9-34.4$ μ m in length (chord), and $15.7-17.7-20.3$ μ m; rare intermediates, 23.4 and 24.7 μ m.

Remarks. Dendy's hypotypes (1896) are considerably larger, more massive than the new specimens. Except for RN 773, which is virtually smooth, and RN 872, with strong relief, surface characters are consistent with the small specimens described above and with the material from the Bahamas described by me earlier. Oscules, however, are mostly considerably larger than in the specimens from Bass Strait. Another special trait, not observed in the new material, is the presence in Dendy's dissected specimens, of a palisade-like zone of parallel incurrent canals, 5–10 mm deep below the ectosome, (pl. 11 fig. 2), similar to those in *Tedania anhelans* and *Forcepia biceps* noted above. Three of Dendy's specimens are from Sorrento Jetty, the remaining ones are from depths of 11 to about 25 m. This indicates that Australian records of this species seem to favour shallow, sheltered conditions like most records from New Zealand, the Indo-Malayan Region, the Indian Ocean, the Mediterranean, and from the Western Atlantic.

The question, whether biogeographic gradients are apparent in the variable spicular traits of this supposedly cosmopolitan species, is still unresolved (van Soest, 1984: 56). Styles in West-Indian specimens have usually been figured or described as subtylostyles (Hechtel, 1965: 39; Simpson 1968a: text-fig. 11; Wiedenmayer 1977a: text-figs 141, 142; van Soest, 1984, text-fig. 19), but Topsent (1925a: 701f.) recorded tapering bases in styles of his own material from Guadeloupe (*Tedania leptoderma* Topsent, 1889), in Carter's type material (*Halichondria isodictyalis*), and in his specimens from Naples and Ambon. The presence of two categories of both chelae and sigmata in Australian and Indonesian specimens, like in van Soest's (1984), is significant. Such a condition is rarely if ever reported in other descriptions (Topsent, 1925a: 703, mentions two categories of sigmata in a specimen from Venice) and may have been overlooked in some cases. Burton and Rao (1932: 331) re-examined Carter's (1886a) and Dendy's (1896) specimens from Port Phillip Bay and found them to agree with *L. ternatensis* (Thiele). They retained the latter as a valid species, to which they added *L. sinensis* Brøndsted as synonym, the only diagnostic character being the two sizes of both chelae and sigmata. Burton (1937: 26) described *L. sinensis* as a good species, without reference to the decision in Burton and Rao (1932). There may have been a delay in publication of the former manuscript. This is the only record of *L. isodictyalis* with repent-ramose shape. Chelae and sigmata are again of two sizes. As van Soest has shown that the latter trait may be present in West-Indian populations of *L. isodictyalis*, there is no need for *L. ternatensis* and *L. sinensis*.

The supposed differences, particularly in dimensions of spicules, cited again by Burton and Rao (1932: 331) to justify the retention of *L. similis* Thiele for Indonesian populations, have been shown to be insignificant by Topsent (1925a, 1936a).

Styles in the new material from Bass Strait are unusually thin (5–6 μ m being common in previously published descriptions). But this may be an expression of the atypical environment.

"Lissodendoryx" jacksoniana (Lendenfeld, 1888), from Port Jackson, Sydney, redescribed and revised by Hallmann (1914c), is a good species, characterised by the addition of small strongyles to the choanosomal skeleton. It has been recorded from South Africa (as *L. isodictyalis jacksoniana*) by Burton (1936a).

Lissodendoryx dendyi (Shaw, 1927a, described in *Hamigera*) is another good species from southern Australia, and is atypical for the genus. The only specimen known is small, erect, compound-clavate, with a characteristic papillate surface. The papillae are of two sizes, osculiferous ones being larger. The inhalant smaller ones have a single apical "pseudostium" over a central porocalyx underlain by a separate concentric vestibule. The ectosomal megascleres are restricted to the inhalant papillae, where they are regularly radially arranged, while the interstitial dermis contains only crowded arcuate chelae with atrophied alae. Most choanosomal megascleres are slightly asymmetrical strongyles like those in the inhalant papillae. Styles are rare in the deeper choanosome. There are no sigmata. The closest relative is *L. papillata* (Dendy, 1922: 90) from the Indian Ocean, which is less specialised, more typical for the genus, but also lacks sigmata.

Ectydoryx Lundbeck

Ectydoryx Lundbeck, 1909: 444. — Topsent, 1928: 53, 55 (definition in Myxillinae). — de Laubenfels, 1936a: 84 (definition in Myxillinae), 85 (comparison with *Hymedemia*). — Lévi in Brien et al., 1973: 612 (definition in Myxillidae). — Van Soest, 1984: 71 (in discussion of Myxillidae).

Diagnosis. Distinct from *Lissodendoryx* by the addition of echinating acanthostyles. Sigmata may be absent.

Ectydoryx maculata Hentschel

Plate 11 figures 3, 4, plate 30 figure 5,
text-figures 65, 66

Ectydoryx maculatus Hentschel, 1911: 342, text-fig. 30 (Albany, WA).

Merriamium maculatum. — de Laubenfels, 1936a: 83 (transfer only).

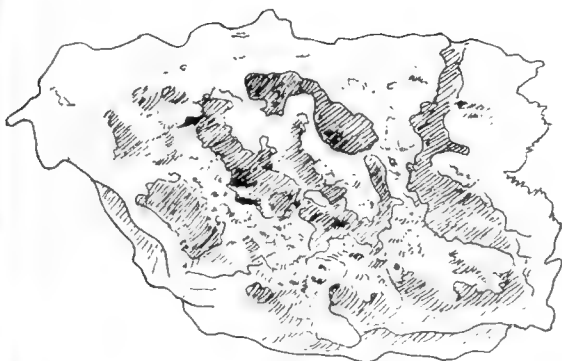


Figure 65. *Ectyodoryx maculata*. F52020, perpendicular section ($\times 3.9$, surface above) showing very cavernous interior.

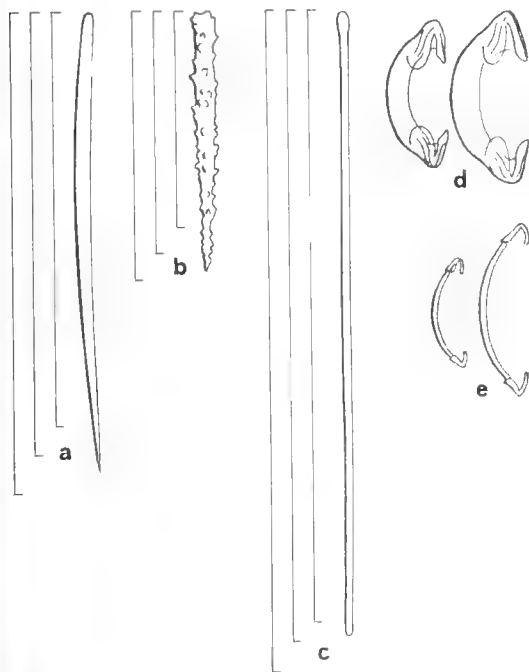


Figure 66. *Ectyodoryx maculata*, spicules from F52020. a. Range and example of principal styles, $\times 263$. b. Range and example of acanthostyles, $\times 263$. c. Range and example of strongyles and subtylostongyles, $\times 263$. d. Range of massive chelae, $\times 789$. e. Range of frail chelae, $\times 789$.

Material examined. Station KG 1, one specimen (F52020); station KG 7, one specimen (52021).

Diagnosis. Cushion-shaped to massive-lobate. Softly spongy, easily torn; orange to vermillion in life. Surface regularly areolate; inhalant and exhalant areoles little differentiated, with raised rim and central depression. Choanosome thoroughly cavernous. Ectosome indistinct, with crowded chelae and subtangential bundles of strongyles,

which also occur radially around inhalant areoles and erect in peripheral choanosome. Main skeleton indistinctly plumo-reticulate, with smooth principal styles and often echinating acanthostyles. Chelae of two sizes, no sigmata.

Description. F52020 thickly incrusting to cushion-shaped, with sinuous margin, 3.7×5 cm wide, 0.5–1 cm high. F52021 massive, erect-lobate, somewhat compressed, with angular apical lobes, 3×4.7 cm wide, 5 cm high. F52020 orange in life, F52021 vermillion (5 R 5–6/11); both now cream to light yellowish beige. Softly spongy, easily torn. Surface with pattern of saucer-like depressions, 1.5–2 mm wide in F52020, about 1 mm wide in F52021, with intervening raised areas about equally wide. Pattern regular except margin, in F52020; in F52021, only distinct on one side. Elsewhere, pattern obscured by dendritic and anastomosing rugae and depressions mostly longitudinally aligned. Round depressions correspond to wholly or partly closed vestibules, atria or mouths of radial canals, all of similar dimensions, communicating in thoroughly cavernous choanosome. Some rounded depressions roofed by membrane bearing indistinct ostia. In others membrane bears iris-like aperture which may be retracted to sharp skeletal rim. Hence differentiation into incurrent sieves and small oscules. Some oscules elongate to slit-like along margin of F52020 and on apices of F52021, here communicating with wider longitudinal canals with angular cross-section. Areolate (swollen) skeletal rim with radial structure in some of round depressions. Main skeleton an often irregular reticulation of fibres, with variably conspicuous spongin. Sometimes distinction of thicker, more continuous branching principal fibres, with little orientation, and mostly oblique, frequently branched anastomoses; the former around $50 \mu\text{m}$ thick, the latter about $20 \mu\text{m}$. Meshsizes 170 to $430 \mu\text{m}$. Fibres cored to packed with subparallel to semi-plumose megascleres, chiefly principal styles, always with some acanthostyles, also as echinators. Megascleres also interstitially in variable amounts, occasionally obscuring meshwork. Chelae numerous interstitially.

Ectosome not distinct, with crowded to packed chelae at surface, and commonly subtangential loose bundles of diacts. Bundles of diacts also in peripheral choanosome, erect or oblique to surface, most conspicuous around vestibules and atria, in regular radial and umbellar pattern.

Spiculation: (1) Principal choanosomal styles, straight to curved or bent, $191\text{--}205\text{--}223 \times 2.6\text{--}5.6\text{--}7.9 \mu\text{m}$. (2) Choanosomal acanthostyles, $100\text{--}112\text{--}124 \times 4.7\text{--}7.9\text{--}10.3 \mu\text{m}$. (3) Dermal and peripheral strongyles and subtylostongyles, occa-

sionally styloids, often with elongate inflation at one end, other end strongylate, tornote or mucronate, subterminally slightly swollen in some, $283\text{--}292\text{--}306 \times 1.8\text{--}3.1\text{--}4.7 \mu\text{m}$. (4) Arcuate chelae of two categories, (2) larger ones of normal type, with strongly arched shaft, length (chord) $23.9\text{--}26.2\text{--}28.4 \mu\text{m}$, total width in profile $9.5\text{--}11\text{--}12.4 \mu\text{m}$, thickness of shaft $3.3\text{--}4.7 \mu\text{m}$; (b) smaller ones with weak, gently arched shaft and much reduced alae, length $17.6\text{--}21.4\text{--}27.2 \mu\text{m}$, total width $5.2\text{--}6.7\text{--}8.3 \mu\text{m}$, thickness of shaft $0.9\text{--}1.9 \mu\text{m}$.

Remarks. The weaker chela was figured (but not described) by Hentschel (1911: 343), as juvenile stage of isochela. The two categories are quite distinct in the new material, without intermediates. The anomalous types of isochelae, described in detail and figured by Hentschel, were not observed by me.

Regularly distributed, round and arcuate sieve-like depressions over vestibules, with radially arranged megascleres in their fringes, and analogous papillae, were described and figured for a number of poecilosclerid species in different families. For Australia, these are notably *Anchinoe* (recte *Phorbas*) *fictitioides* Dendy and Frederick (1924) and *Lissodendoryx dendyi* (Shaw, 1927a; see end of Remarks on *Lissodendoryx isodictyalis*, above).

Anchinoidae Topsent, 1928

Synonym. Phorbasidae de Laubenfels, 1936.

Remarks. Phorbasidae was introduced by de Laubenfels (1936a: 62) without reference to its senior synonym Anchinoidae (the type genus of which he included in Phorbasidae, synonymising it with *Phorbas*). It can be surmised that the seniority of *Phorbas* prompted de Laubenfels' action. Phorbasidae has been adopted by some followers of de Laubenfels' system, most recently by Hoshino (1981), but also by van Soest (1984: 86). However Lévi (in Brien et al., 1973) and his collaborators, Bergquist (1978) and Pulitzer-Finali (1983) have used Anchinoidae.

Phorbas Duchassaing and Michelotti

Phorbas Duchassaing and Michelotti, 1864: 91. — de Laubenfels, 1936a: 63 (definition). — Bergquist, 1961b: 180 (discussion). — Van Soest, 1984: 86 (definition, description of type species), 88 (discussion).

Anchinoe Gray, 1867a: 535. — Topsent, 1928: 56, 57, 61. — de Laubenfels, 1936a: 64 (synonymised with *Phorbas*). — Lévi in Brien et al., 1973: 613 (definition). — Van Soest 1984: 88 (synonymised with *Phorbas*).

Suberotelites Schmidt, 1868: 12. — Topsent, 1938a: 12 (discussion, type species re-examined, synonymised with *Anchinoe*).

Diagnosis. "[Anchinoidae] in which the choanosomal skeleton consists of columns of acanthostyles mixed with ectosomal oxecotes, echinated by a special category of acanthostyles; microscleres arcuate isochelae." (Van Soest, 1984: 86.).

Phorbas cf. *tenacior* Topsent

Plate 11 figures 5a, b, plate 30 figure 4, text-figure 67

Selected synonymy of sibling species and subspecies:

Anchinoe tenacior Topsent, 1925a: 666, text-fig. 16 (Naples, Monaco). — Rützler, 1965: 33 (Yugoslavia; description, ecology, further references). — Boury-Esnault, 1971: 318 (W Mediterranean; description, ecology, further references). — Sarà, 1972: 80, text-fig. 9A, pl. 1, fig. 2 (in colour). — Pulitzer-Finali, 1978: 60 (Naples; ecology, colour, spiculation). — Pulitzer-Finali, 1983: 566 (Mediterranean; ecology, colour, spiculation).

Anchinoe coriaceus (Fristedt) var. *tenacior*. — Topsent, 1936a: 41 (Monaco; description, discussion).

Material examined. Station BSS 181, one specimen (I-52022).

Diagnosis. Elongate, surface irregularly convoluted, lacunose and lobulate to brain-like, almost lipostomous. Firmly spongy to leathery, dull greyish orange-yellow in life. Ectosome indistinct,



Figure 67. *Phorbas* cf. *tenacior*, spicules. a. Range of subtylotes and subtylostrongyles, with example of the latter, $\times 263$. b. Enlarged ends of a subtylote, $\times 788$. c. Large acanthostyles, $\times 263$. d. Small acanthostyles, $\times 263$. e. Range of chelae, $\times 788$.

with crowded chelae and subtangential to irregularly bundled (subtylo-)strongyles. Choanosome dense, collagenous, with some sand. Main skeleton vaguely columnar to confused, with strongyles/subtylotes/subtylostrongyles and two sizes of acanthostyles. Arcuate chelae of one kind.

Description. Capricious elongate shape. Surface thrown into lacunae, elongate partly longitudinally partly transversely, some straight, others curved or crooked; their section round, semicircular to circular. Raised areas rugose and lobulate, mostly in cerebroid pattern. Some portions of lacunae separate or traversed by thin bridges; some ends of lacunae communicate through round to elongate windows. Length 7 cm, width at the base 3×3.5 cm. Base was attached to chaetopterid worm tubes, tapers slightly to lobulate apex. Lacunae 0.5 to 1 cm wide and up to 5 cm long, raised areas about 1–2 cm wide, with rugae and lobules 1–3 mm wide. Dull, greyish orange-yellow in life (10 YR 5–6/6), now, in alcohol, faded (10 YR 6–7/4–6). Firmly spongy to leathery. Walls of lacunae microscopically mostly smooth, glabrous, except some transverse nervures and finely papillate pattern in some areas. Subdermal round vestibules, 200–1000 μm wide, numerous especially in depressions between rugae and lobules, with interspersed oscules of similar dimensions. Crowded, very fine ostia indistinct in depressions, over vestibules, also in fields of irregular outline on top of rugae and lobules. Scattered and clustered sand grains everywhere in dermis.

Main skeleton chaotic, some vague strands of megascleres discernible, chiefly of bundled strongyles and subtylotes, with few large acanthostyles; the latter also echinating with more numerous small acanthostyles. Strands usually meandrine to convoluted, frequently crowded to almost confluent. Megascleres of all sorts also scattered at random, as microscleres. Yellow spongin discontinuous, enveloping several contiguous strands, without clear outline.

Ectosome indistinct, with crowded chelae at surface, subtangential and vaguely umbellate arrangement of strongyles (the latter especially around vestibules). Sand grains more numerous below surface, scattered in dense, collagenous choanosome.

Spiculation: (1) Smooth strongyles (rare) mostly modified as subtylostrongyles and subtylotes, the latter commonly asymmetrical, $212\text{--}219\text{--}228 \times 2.3\text{--}2.8\text{--}3.3 \mu\text{m}$; (2) two categories of acanthostyles, (a) larger ones often gently curved, $146\text{--}154\text{--}166 \times 7.2\text{--}8.9\text{--}10.2 \mu\text{m}$ (with spines), (b) smaller ones straight, $67\text{--}77\text{--}80 \times 6.7\text{--}9.3\text{--}11.2 \mu\text{m}$ (with spines); (3) arcuate chelae with strongly curved

shafts, $15.3\text{--}18.4\text{--}20.7 \mu\text{m}$ in length (chord), $5.1\text{--}7.9\text{--}9.3 \mu\text{m}$ width in profile, $1.1\text{--}2.2\text{--}2.5 \mu\text{m}$ in thickness of shaft.

Remarks. Measurements for megascleres in Mediterranean specimens are generally somewhat higher as published, but there is a good agreement with Boury-Esnault's figures, except for only slight overlap in the small acanthostyles. Their smooth megascleres are generally pure strongyles only, but Topsent (1936a) noted occasional weak distal swellings. Mediterranean specimens are usually encrusting, of "*Hymedesmia*-type", but massive, "*Anchinoe*-type" specimens were reported by Topsent (1925a). The colour of the surface in Mediterranean specimens is commonly blue (deep, to greyish), that of the choanosome being yellowish to ochre. However, a minority of yellowish specimens occurs according to Pulitzer-Finali.

Topsent (1936a) regarded *tenacior* as a variety (subspecies) of *coriaceus*, which is also common in the same area, because the latter differs only in lacking chelae, in having smooth megascleres more decidedly as subtylotes, and in its surface being more variable in colour (yellow, purplish sienna brown, grey, bluish grey, whitish, in thin crusts; pink, pink with yellow spots, off-white, in ramose specimens). Both display the same differentiation into thin incrustations and a much rarer ramose morphotype. All other traits are shared, particularly the yellowish choanosome, the glabrous ("waxy") surface, the thick leathery ectosome (thicker and better differentiated than in the Australian specimen). Boury-Esnault (1971) segregated the two as species on the grounds of morphological differences being consistent with ecological (depth-range) segregation, though contiguous. They obviously constitute a sibling pair. The ramose specimens of *tenacior* from Naples were not described in detail by Topsent (1925a), as to external shape, but those of *coriaceus* from Monaco were described as having sparsely divided, fleshy, angular branches, beset by low, frequently interrupted ribs, or by irregular, low tuberosities, hence apparently quite similar to the present specimen.

It seems likely that the single new record for Australia represents a distinct species or subspecies, but it seemed unwise to name it as such before any more material is found.

Order Haplosclerida Topsent, 1928

Callyspongiidae de Laubenfels, 1936

Callyspongia Duchassaing and Michelotti

[*Tuba*] Duchassaing and Michelotti, 1864: 44 (junior

homonym of *Tuba* Lea, 1833; see Wiedenmayer, 1977a: 100, under *Spinossella*).

Callyspongia Duchassaing and Michelotti, 1864: 57. — Wiedenmayer, 1977a: 90 (synonymy, references, discussion). — Bergquist and Warne, 1980: 24 (synonymy, definition, discussion, résumé). — Van Soest, 1980: 46, 56, 110 (definition, discussion with subgenera *Callyspongia* and *Spinossella*).

Cladochalina Schmidt, 1870: 35. — Lendenfeld, 1887a: 768. — Burton, 1927a: 295 (designation of type species, revision of Lendenfeld, 1887a).

?*Platychalina* Ehlers, 1870: 21. — Burton, 1936a: 143 (as synonym of *Homoeodictya*). — Van Soest, 1980: 60 (probably senior synonym of *Callyspongia*, subgenus *Spinossella*).

Tubulodigitus Carter, 1881a: 376. — Burton, 1934a: 536 (neotype of type species redescribed).

Patuloscula Carter, 1882b: 365. — de Laubenfels, 1936a: 57, 59 (definition, synonymised with *Toxochalina*). — Wiedenmayer, 1977a: 90 (references).

Siphonochalina sensu Ridley, 1884a: 401, and of authors (part).

nec *Siphonochalina* Schmidt, 1868: 7 (see van Soest, 1980: 113).

Toxochalina Ridley, 1884a: 402. — Ridley and Dendy, 1887: 49. — Dendy, 1905: 139 (definition). — Topsent, 1928: 66. — Van Soest, 1980: 110 (synonymised with *Callyspongia*). — Bergquist and Warne, 1980: 24 (synonymised with *Callyspongia*).

Spinossella Vosmaer, 1885 (in 1887): 342 (nomen novum for *Tuba* Duchassaing and Michelotti, 1864, nec Lea, 1833). — Lévi in Brien et al., 1973: 618 (synonymy, discussion). — Wiedenmayer 1977a: 100 (synonymy, definition, discussion). — Van Soest, 1980: 56 (definition as subgenus of *Callyspongia*), 64 (discussion). — Bergquist and Warne, 1980: 24 (discussion).

Dactylia Carter, 1885c: 309. — de Laubenfels, 1936a: 59 (discussion, revision). — Van Soest, 1980: 110 (definition, probably a synonym of *Callyspongia*). — Bergquist and Warne, 1980: 34 (definition, distinct from *Chalinopsilla*).

[*Chalinopsis*] Lendenfeld, 1886c: 569 (junior homonym of *Chalinopsis* Schmidt, 1870).

Dasychalina Ridley and Dendy, 1886: 329 (type species: *D. fragilis* Ridley and Dendy). — Burton, 1932a: 278 (designation of type species, diagnosis, discussion). — Wiedenmayer, 1977a: 100 (discussion as synonym of *Spinossella*).

Chalinopora Lendenfeld, 1887a: 740, 764 (type species: *Chalinopora typica* Lendenfeld, 1887a, by typonymy). — Burton, 1927a: 293 (invalid designation of *Acervochalina claviformis* Carter, 1886, as type species). — Burton, 1934a: 535 (ditto).

Chalinella Lendenfeld, 1887a: 740, 770. — Burton, 1927a: 296 (revision, synonymised with *Cladochalina*).

Ceraochalina Lendenfeld, 1887a: 740, 778 (type species: *Ceraochalina typica* Lendenfeld, 1887a, by typonymy). — Dendy, 1905: 152 (definition). — Burton, 1934a: 540 (invalid designation of *Cladochalina nuda* Ridley, 1884a, as type species). — Van Soest, 1980: 118 (genus dubium in Haplosclerida, wrong type species). —

Bergquist and Warne, 1980: 24 (synonymised with *Callyspongia*).

Euplacella Lendenfeld, 1887a: 741, 789. — Burton, 1934a: 597 (definition, résumé, discussion, synonymised with *Placochalina*). — de Laubenfels, 1936a: 59 (discussion, invalid designation of type species). — Van Soest, 1980: 110, text-fig. 39 (definition, retained in Callyspongiidae).

Placochalina Lendenfeld, 1887a: 741, 790. — de Laubenfels, 1936a: 59 (subsequent designation of type species).

[*Siphonella*] Lendenfeld, 1887a: 742, 808 (junior homonym of *Siphonella* Macquart, 1835). — Burton, 1934a: 540 (revision). — Van Soest, 1980: 118 (genus dubium in Haplosclerida, wrong type species).

Euchalina Lendenfeld, 1887a: 742, 816 (type species: *Euchalina typica* Lendenfeld, 1887a, by typonymy). — Burton, 1934a: 540 (invalid designation of *Euchalina rigida* Lendenfeld, 1887a, as type species). — de Laubenfels, 1936a: 47 (Burton's mistake corrected). — Van Soest, 1980: 118 (genus dubium in Haplosclerida, wrong type species).

Chalinopsilla Lendenfeld, 1888: 104 (nomen novum for *Chalinopsis* Lendenfeld, 1886, nec Schmidt, 1870). — Lendenfeld, 1889b: 124 (with *Dactylia*, *Paraspongia*, *Psammoclema* as synonyms). — Laubenfels, 1936a: 59 (synonymised with *Dactylia*). — Bergquist and Warne, 1980: 33, 34 (definition, distinct from *Dactylia*).

Arenosclera Pulitzer-Finali, 1982b: 123.

Diagnosis. Callyspongiidae with distinct ectosomal skeleton, either as tangential net of primary and secondary (sometimes tertiary) spongin fibres, or as abrupt peripheral condensation of main skeleton, by intense branching and intercalation of primaries and crowding of secondaries. Main skeleton may contain ascending fibre fascicles ending in spines at surface. Magascleres oxea or strongyles, generally coring to packing fibres, occasionally also interstitial, in some species also in erect brushes at surface. Toxa may be present, occasionally alone. Spicular skeleton may be reduced or suppressed, and aspiculous fibres may be regularly cored by foreign detritus. Foreign inclusions may also occur in spiculiferous fibres, interstitially and on surface.

Remarks. *Callyspongia* and *Spinossella*, which I had regarded as distinct genera in 1977a, were treated as subgenera of *Callyspongia* by van Soest (1980). *Platychalina* Ehlers (1870) might eventually replace *Spinossella*, pending re-examination of its type species, *Spongia foliacea* Esper, according to van Soest (1980: 60). Esper's type material, however, is very probably lost according to my recent enquiries in Erlangen, Frankfurt (Senckenberg Museum) and Munich (Zoologische Staatssammlung), except for some slides by Thiele in East Berlin (ZMB), and the schizoholotype of *Spongia papyracea* in London (BMNH). Both van Soest and I have over-

looked that *Spinoseella*, if retained as subgenus, is best replaced by *Cladochalina* Schmidt (type species: *Tuba armigera* Duchassaing and Michelotti, 1864; Schmidt, 1870, subsequent designation by Burton, 1927a: 295). If the subdivision of the genus *Callyspongia* were to be maintained, it would seem advisable to treat *Euplacella* (which van Soest, 1980, regarded as a distinct genus) as a third subgenus. In this case, however, it would have to be replaced by its senior synonym (by page priority) *Ceraochalina*. The overlooked type species of the latter, *C. typica*, is clearly a junior synonym of *Callyspongia serpentina* (Lamarck) (= *C. communis* of authors), as my survey of Lendenfeld's types in Sydney and London revealed. The distinction of the two subgenera *Callyspongia* and *Cladochalina* is not always practical with Indo-West Pacific and Australian material. If Burton's (1959: 225) synonymy of *Callyspongia spinosissima* (Dendy) is accepted, we would have morphotypes with coarsely spiny surface (*spinosissima*) and morphotypes with smooth surface (*subcylindrica*). *Callyspongia truncata* Lendenfeld (1887a), (with most of his "species" of *Siphonochalina* as synonyms) likewise comprises morphotypes of both sorts. Another case in point is *Callyspongia tuberculata* (Lendenfeld 1887a, comprising 4 of his 5 "species" of *Siphonella* as synonyms) in which the characters of the nominate subgenus (annular swellings, bullae, smooth portions) are often combined with tubercles and spines. The retention of *Ceraochalina* as a subgenus is impractical, because its only diagnostic trait (the presence of erect spicule brushes at the surface) is not consistently developed in at least one species: it may or may not be present in the polymorphic *Callyspongia ramosa*. Bergquist and Warne (1980) distinguished *Chalinopsilla* and *Dactylia* on the grounds of foreign material coring the primary fibres of the latter, but being completely absent in the former. This distinction has a major nomenclatorial drawback: the type species of *Chalinopsilla* (by subsequent designation in Bergquist and Warne, 1980, not by monotypy), *C. dichotoma* (Lendenfeld, 1886e), has foreign bodies (chiefly foreign spicules), both in primaries and secondaries, according to Lendenfeld (1889b: 143, pl. 3 fig. 11). But neither such a distinction within aspiculous species, nor a separate genus for aspiculous callyspongiids seems necessary to me from a taxonomic point of view. In my experience with Australian callyspongiids, including many type specimens, foreign detritus occurs in both spiculiferous and aspiculous species, to a variable degree. I had earlier noted detritus in the fibres of *Callyspongia pallida* (as *C. fallax* forma *debilis* in

Wiedenmayer, 1977a: 95). Though detritus tends to interstices in spiculiferous ones, it may incrust the surface of both. Different species with vestigial the surface of both. Different species with vestigial spiculation are known both from the West Indian region and from the Indo-West Pacific region. It is possible that the loss of megascleres is an acquired character within the Callyspongiidae, and that the presence of toxa, though facultative and individually variable, is an ancestral trait shared with other haplosclerids. This is suggested by the new species of *Callyspongia* described below, in which all fibres are aspiculous, and in which interstitial toxa may be present in variable abundance; but also by the species (species complex?) *Callyspongia ramosa* (see below), which is highly polymorphic, also with regard to some skeletal traits, particularly in the occasional presence of toxa. Toxa also occur in some species of Renieriidae ("Orina", "Toxadocia"), Niphatidae (*Microxina*, of which *Hemigellius* is here considered a synonym), and Oceanapiidae ("Biminia") (see van Soest, 1980). It could be argued, however, that both loss of megascleres and of toxa (and, in analogy, of sigmata in non-callyspongiid haplosclerids) are due to parallelism, and occurred in lineages linking various ancestral poecilosclerids and derived, polyphyletic Dictyoceratida. Strong reduction of megascleres, however, is much less common in non-callyspongiid haplosclerids, and occurs, for instance, in the West-Indian *Amphimedon complanata* (see van Soest, 1980: 31), and in the Australian *Amphimedon? crassiloba* (Lamarck) (choanosome only).

Presence/absence of spicules and of foreign detritus are here interpreted as poorly correlated, diatoxonic traits and as differences of degree within the Callyspongiidae, with *Chalinopsilla* sensu Bergquist and Warne, and *Arenosclera* Pulitzer-Finali as extremes. *Paraspongia* Carter, which Lendenfeld (1889b: 145) regarded as an "obsolete" synonym (relating to Lendenfeld's nomenclatorial idiosyncrasies, see Wiedenmayer et al., in press) of his *Chalinopsilla* (over which it would, as such, have priority), is very poorly known. I suspect it to be a junior synonym of *Phoriospongia*.

Dasychalina, as revived by Burton (1932a) for *Pachychalina fragilis* Ridley and Dendy, and *P. validissima* Thiele (1905), merely represents extremes in the variable skeletal structure of *Callyspongia* outlined in the new diagnosis above. Fibres packed with spicules occur in *Callyspongia conica* (Brøndsted), *C. irregularis* Bergquist and Warne, and *C. stellata* Bergquist and Warne (Bergquist and Warne, 1980: 27, 29, 32). All three spe-

cies have abundant interstitial megascleres in the choanosome, as has *C. persculpta* described below.

***Callyspongia asparagus* (Lamarck)**

Plate 11 figure 6, plate 31 figures 2, 3,

text-figure 68

Spongia asparagus Lamarck, 1814 (1813-1814): 447 (Australian Seas, Péron and Lesueur collection).

Chalina asparagus. — Ridley, 1884a: 405 (schizotype in BMNH mentioned, comparison with *Pachychalina macrodactyla*).

Cladochalina asparagus. — Topsent, 1932a: 106, pl. 6 fig. 7 (description of type fragments, discussion).

Material examined. Station BSS 187, one specimen (F52024).

Diagnosis. Sparsely branched; branches knotty, with blunt tips, 0.5–1 cm thick. Firmly spongy, pink in life. Oscules numerous, unilateral or bilateral, around 1 mm wide. Surface smooth, with dense tangential reticulum. Main skeleton lax, coarse, irregular. Choanosome scanty. Spicules small, scanty, irregularly distributed in fibres only.

Description. Three unequal branches (one now dissected) divergent from one point and curved in one plane. One branch proximally enveloped by cerebroid to lacunose, coarsely sandy, slightly compressible mass, possibly an undescribed *Psammoclema*. Same mass supports frondose bryozoan. Branches of *Callyspongia* mostly compressed, somewhat knotty, 0.5 to 1 cm thick; one terminally more compressed, almost spatulate.

Pink in life now faded, mostly to yellowish beige, partly still pale red-brown. Firmly spongy.

Surface smooth, also microscopically, finely mottled by vestibules in peripheral meshes. Oscules numerous, confined to narrow upper face, round to elongate, 0.5 to 1.5 mm wide. Superficial reticulum continuous except on branch tips, here with coarse main skeleton exposed. Finer superficial meshwork mostly obscured by fine calcareous sediment, only darker primary tangential fibres standing out. Pronounced contrast between dense surface reticulum and lax, open, relatively coarse and irregular meshwork of interior. Flesh scanty, tympanising some of meshes, contains fine calcare-



Figure 68. *Callyspongia asparagus*, spicules (strongyles and strongyloxea), $\times 742$.

ous sediment. In dermal skeleton, primaries around 45 μm thick, secondaries around 20 μm , tertiaries around 8 μm . Corresponding meshsizes around 1 mm, 170–350 μm , and 45–85 μm , respectively. Main skeleton with incomplete segregation of primaries, 95–130 μm , spaced 580 to 1200 μm , and secondaries, 47 to 62 μm thick, spaced 290 to 870 μm . Spicules scanty, confined to fibres, distributed irregularly, more numerous in some fibres, almost lacking in others; indistinctly aligned or randomly oriented, coring (then often broken) or occupying whole thickness of fibre; clearly visible or barely discernible.

Spiculation: Strongyles transitional to tornotes and strongyloxea, 63.5–72.2–85 \times 1.5–2.1–3.1 μm .

Remarks. See *Callyspongia pergamentacea*, below.

***Callyspongia bilamellata* (Lamarck)**

Plate 11 figure 7, text-figure 69

Spongia bilamellata Lamarck, 1814 (1813-1814): 434 (part, typical form only, not var. β ; Australia (as Southern Ocean), Péron and Lesueur collection).

Cavochalina bilamellata. — Carter, 1885d: 287 (part; Port Phillip Heads).

Pachychalina bilamellata. — Dendy, 1895: 242 (Port Phillip Heads). — Whitelegge, 1902b: 287.

Cladochalina bilamellata. — Burton, 1927a: 509.

Cribrachalina bilamellata. — Topsent, 1932a: 68 (redescription of Lamarck's types of typical form).

nec *Spongia bilamellata* var. β Lamarck, 1814 (fide Topsent, 1932a: 69, correctly *Echinodictyum mesenterium*).

nec *Echinodictyum bilamellatum*. — Ridley in Ridley and Duncan, 1881 (*Spongia bilamellata* var. β redescribed from schizotype). — Topsent 1932a: 69 (for above).

Euplacella australis Lendenfeld, 1887a: 789 (Torres Strait; junior secondary homonym of *Dactylochalina australis* Lendenfeld, 1886f.). — Burton, 1934a: 598 (Great Barrier Reef).

Pachychalina australis. — Whitelegge, 1906: 457 (off Coogee, off Bulgo, off Wollongong, NSW). — Burton, 1927a: 509 (revision).

Euplacella frondosa Lendenfeld, 1887a: 789, pl. 21 fig. 36 (Port Jackson, NSW; Gulf St Vincent, SA).

Euplacella mollissima Lendenfeld, 1887a: 790, pl. 21 fig. 37 (Westernport Bay, Vic.). — Whitelegge, 1902a: 215



Figure 69. *Callyspongia bilamellata*, spicules, $\times 782$. a. Oxea in fibres. b. Interstitial oxea.

(coast of NSW).—Burton, 1934a: 598 (synonymy, types in BMNH re-examined; Great Barrier Reef).

Placochalina pedunculata var. *dura* Lendenfeld, 1887a: 791, pl. 21 fig. 38 (Port Jackson, NSW).—Lendenfeld, 1888: 91.—Whitelegge, 1889: 182 (Coogee, Bondi, NSW).—Whitelegge, 1902b: 279, 287.

Placochalina pedunculata var. *poculum* Lendenfeld, 1887a: 792, pl. 21 fig. 39 (Torres Strait; Illawarra and Port Jackson, NSW).—Lendenfeld, 1888: 91.—Whitelegge, 1902b: 279, 287.

Placochalina pedunculata var. *mollis* Lendenfeld, 1887a: 792, pl. 21 fig. 35 (Gulf St Vincent).—Lendenfeld, 1888: 92.—Whitelegge, 1902b: 279, 287 (revision of 2 syntypes).

Pachychalina punctata (nec Ridley and Dendy): Whitelegge, 1889: 182 (Port Jackson and Bondi Beach, NSW).—Whitelegge, 1901: 69 (Tuggerah Beach, NSW).—Whitelegge, 1906: 458 (off Barranjoey, NSW).

Material examined. Station KG 9, one specimen (F52025). Type specimens of *Euplacella australis*, *E. frondosa*, *E. mollissima*, *Placochalina pedunculata* var. *dura*, *poculum*, and *mollis* (AM and BMNH). Hypotypes of *Cavochalina bilamellata*: Carter, 1885d (BMNH); of *Pachychalina bilamellata*: Dendy, 1895 (NMV); of *Euplacella australis* and *E. mollissima*: Burton, 1934a (BNMH); of *Pachychalina australis*: Whitelegge, 1906, *Euplacella mollissima*: Whitelegge, 1902a, *Pachychalina punctata*: Whitelegge, 1901, 1906 (AM).

Diagnosis. Stalked, caliculate. Cup inverted-conical, often asymmetrical, compressed, bilaterally deeply incised and hence bilamellate. Outer surface commonly coarsely rugo-reticulate, inner surface concentrically ridged. Externally sculptured cups almost lipostomous, smooth ones with more conspicuous, numerous and regular oscules in concavity. Rubbery, tough; dull light red to pinkish grey in life. Surface smooth, but often microhispid. Ectosome with erect spicular brushes, umbellate to finely cancellate. Main skeleton regular, bilateral-symmetrical in fronds. Spongin abundant, primary fibres well cored by spicules, secondaries with thin spicular cores. Small oxea, smaller interstitially, with strongyles.

Description. Stalked asymmetrical cup, roughly inverted-conical. Stalk crooked, knotty, 2–2.5 cm wide and 16 cm long, with rhizomatous base. Height of cup 27 cm on higher side, 10 cm on opposite side. Wall mostly 0.5 to 1 cm thick, longitudinally folded, with concentric ridges on inside, coarsely rugo-reticulate relief on outside. Rim sharp, sinuous or obtusely notched. Fine, faint radial striation throughout inside, only 1–2 cm deep below rim on outside. Dull light red to pinkish grey in life (10R 7/2–8 to 10 R 8/8 inside, 10 R 6–8/4–6 outside), now greyish yellow-brown (7.5–10 YR 6–7/2–4). Rubbery.

Surface optically smooth except relief mentioned above. Oscules inconspicuous in concavity, minute, not above 200 μm in width, numerous, regularly scattered. Outer surface with coarse primary tangential fibres just below surface, outlining rounded meshes subdivided by indistinct finer fibres; secondaries and tertiaries mostly indistinct. Pattern obscured by crowded microconules (spicular brushes) and fine sediment.

In margins, regular radial primaries curve gently from mesial plane, meeting surface almost perpendicularly, branching frequently in curves; some as sudden intercalations; spacing 140–350 μm , thickness 35–130 μm . Secondaries generally more crowded, spaced mostly around 125 μm , up to 430 μm , parallel to surface; few branching or connected by short radial anastomoses. Thickness as for primaries. Spongin abundant, meshes commonly rounded, with radial widths often equal or below those of fibres. All fibres conspicuously cored by spicules, core occupying fifth to third of thickness in primaries, with at least 6 spicules abreast, in secondaries commonly 1–4 spicules abreast. Spicules aligned to semiplumose, frequently fanning at junctions, occasionally disheveled, especially in periphery.

Peripheral skeleton frequently less regular, less segregated from main skeleton where thick, spicules dominating over spongin. Where more distinct, equal to 1–3 spicule-lengths in thickness, spicules even more abundant, in vaguely umbellar to cancellate bundles, reminiscent of periphery in *Cribrochalina*.

Main skeleton interrupted in irregular intervals by similarly condensed zones parallel to present marginal surface, reflecting earlier growth stages.

Spiculation: Fusiform oxea in fibres, curved to symmetrically bent, 60.9–65–71.8 \times 2.3–3–4 μm . Interstitial oxea and strongyles, 38.1–45.9–54.5 \times 0.7–0.9 μm .

Remarks. There is a pronounced affinity, in the ectosomal skeleton of this species, to the genus *Cribrochalina*. In the latter, however, erect spicular brushes form continuous palisades along the edges of the outermost secondaries, while in *Callyspongia bilamellata* erect spicules at the surface are grouped in isolated tufts. The synonymy suggested above should be qualified with regard to *Euplacella australis*, *E. frondosa*, and *Pachychalina punctata* sensu Whitelegge. These specimens differ from the typical specimen described above in two traits, and could be regarded as a distinct subspecies or form. The two traits are: absence of the rugo-reticulation on the outside (or convex side of single fronds) and presence on the inside or con-

cave side of conspicuous round oscules (width around 1 mm). Both forms, however, agree in the dominantly bilamellate to caliculate, stipitate growth form, colour and consistency. Burton (1934a: 498) distinguished the two as species (calling the typical form *Euplacella mollissima*, yet unaware of Topsent's redescription of *Spongia bilamellata*), but at the same time doubted that the latter was really distinct from *E. australis* (correctly *frondosa*). Some growth forms of *frondosa* resemble *Pachychalina punctata* Ridley and Dendy, which is a typical *Cribrochalina*. It differs from *frondosa* externally by having thicker, more irregular and lumpy fronds, with thick rims and frequent perforations, larger, more widely spaced and irregularly scattered oscules, and harder consistency. Several hypotypes of *Cavochalina bilamellata*: Carter belong to *Cribrochalina punctata*.

Callyspongia diffusa (Ridley)

Plate 11 figures 8–10, plate 31 figures 4, 5,

text-figure 70

Provisional synonymy.

Cladochalina diffusa Ridley, 1884a: 672 (caption only), pl. 41 fig. D (Singapore). — Ridley, 1884c: 183 (description, discussion).

Callyspongia diffusa. — Burton, 1934a: 541, text-fig. 6 (synonymy, discussion; Great Barrier Reef). — de Laubenfels 1950a: 12, text-fig. 6 (Hawaii). — Guiler, 1950: 6 (Tasmania). — de Laubenfels, 1954a: 86, text-fig. 51, pl. 4b (Caroline Islands, Mariana Islands). — Burton, 1959: 224 (Gulf of Aden, Zanzibar area). — Bergquist and Warne, 1980: 27, pl. 13 a–d (description, discussion; New Zealand, intertidal–2 m).

Acervochalina finitima. — Ridley, 1884a: 399 (nec Schmidt, part: specimen from Port Jackson, NSW, only, fide Burton, 1934a: 541).

Chalinopora lamella Lendenfeld, 1887a: 757 (Port Jackson, NSW). — Lendenfeld, 1888: 85. — Whitelegge, 1902b: 278, 285 (2 syntypes redescribed).

Cladochalina lamella. — Burton, 1927a: 294 (transfer only).

Pachychalina manus Lendenfeld, 1887a: 777 (Port Jackson). — Lendenfeld, 1888: 88. — Whitelegge, 1889: 182 (Shark Reef, Port Jackson; Maroubra Bay, NSW). — Whitelegge, 1902b: 278, 284 (3 syntypes re-examined, 2 removed).

Cladochalina manus. — Burton, 1927a: 508, 510 (revision).

Ceraochalina multiformis var. *digitata* Lendenfeld,

1887a: 784 (part: specimen from Port Jackson only, fide Burton, 1934a: 541).

Pachychalina multiformis var. *manaarensis* Dendy, 1889d: 79 (Tuticorin Pearl Banks, Gulf of Mannar).

Ceraochalina multiformis var. *manaarensis*. — Dendy, 1905: 154, pl. 7 fig. 2 (Gulf of Mannar, Sri Lanka). — Dendy and Frederick, 1924: 500 (Abrolhos Islands, WA).

?*Siphonochalina crassifibra* Dendy, 1889d: 82 (Tuticorin Pearl Banks).

Chalina pulvinatae Lindgren, 1897: 481 (Java). — Lindgren, 1898: 295, pl. 18 figs. 2, 16; pl. 19 fig. 7 (spelled *pulvinatus*, description, discussion).

Callyspongia pulvinatae. — van Soest, 1982: 90, text-fig. 9 (Hong Kong).

Ceraochalina retiarmata Dendy, 1905: 152, pl. 10 fig. 4 (off Chilaw, Sri Lanka).

?*Ceraochalina ceylonica* Dendy, 1905: 154, pl. 7 fig. 3, pl. 10 fig. 6 (Gulf of Mannar, Sri Lanka).

Chalina palmata. — Dendy and Frederick, 1924: 499 (Abrolhos Islands, WA; nec *Spongia palmata* Lamarck, nec *Chalina palmata*: Ridley and Dendy).

Material examined. Station BSS 187, one specimen (F52026). Syntypes of *Cladochalina diffusa* (BMNH). Type specimens of *Chalinopora lamella*, *Pachychalina manus* (AM, BMNH).

Diagnosis. Variably branched, with branches sparse or prolific, stubby or long and tapering, frequently angular, knotty, moniliform, or compressed, erect or repent, anastomosing; or massive, lobate, tubular, flabellate. Firmly spongy, occasionally softer, slightly viscid. Gold to mauve, or dark brown in life. Numerous oscules often raised on knots and lobes, apical and marginal on lamellae. Surface generally smooth, but hispid on elevations. Ectosomal reticulum variable in density, subdivision and depth, with erect spicular brushes. Main skeleton irregular. Spicular core in all fibres thick, dense, many fibres packed with oxea.

Description. Few, sparsely subdivided, straggling branches, generally knotty and angular, more so proximally, where almost serrated; tips tapering, almost smooth, terete to slightly compressed. Serrated appearance through numerous oscules (width 0.5–1 mm) on top of tubercles and cones, mostly aligned longitudinally, hence polygonal cross-section of branches proximally. Total height 35 cm, thickness of branches 1 cm proximally, 3–5 mm distally. Dark brown in life, now faded (7.5 YR 5–6/4–6). Firmly spongy, slightly viscid. Surface, except elevations mentioned, smooth, also microscopically. Very fine ectosomal reticulum apparent only with intermediate magnification. Primary meshwork wider in depressions, with indistinct subjacent vestibules forming speckled pattern. Over elevations, primary meshwork distinctly denser, darker, micropapillate. In ectosome,



Figure 70. *Callyspongia diffusa*, oxea, $\times 943$.

only tangential primaries and secondaries can be distinguished. Primaries 13–17 μm thick, cored by 4–6 spicules abreast, enclosing meshes around 175 μm wide. Secondaries 8–9 μm thick, cored by 1–2 spicules abreast, with mesh sizes around 60 μm . Spicule brushes echinate surface at nodes and inbetween. Nodes frequently capped by bulbous spongin, occasionally coalescent between neighbouring nodes, producing micropapillate appearance noted above. Meshwork of main skeleton irregular, with primaries often straggling and secondaries commonly oblique. Primaries 33 to 63 μm thick, spaced 208 to 440 μm ; secondaries 18–44 μm thick, spaced 110 to 218 μm . Half of diameter in primaries cored by more or less aligned oxea, some portions almost filled. Spicular core in secondaries proportionately thinner, occasionally reduced to one spicule.

Spiculation: Hastate to fuisform oxea, straight to gently curved or bent, 50.6–59.8–67.1 \times 1.5–2.7–3.3 μm .

Remarks. The synonymy suggested above is largely that of Burton (1934a), with the exception of some names of Lendenfeld (1887a): of those included by Burton, *Cladochalina elegans* is a good species of *Callyspongia*, while *Chalinissa ramosa* (also cited by Burton, 1934a: 598, as a synonym of *Euplacella communis*) is indeed a synonym of *Callyspongia serpentina* (see below). *Chalinopora lamella* and *Pachychalina manus* are here added to the syn-

onymy chiefly following Burton's manuscript indications on the labels with the syntypes in London (BMNH). *Siphonochalina crassifibra* Dendy (1889d) was merged in *Callyspongia diffusa* by Burton (1934a), but this may be a synonym of *Callyspongia bullata* (Lamarck). The synonymy of *Ceraochalina ceylonica* Dendy (1905) is doubtful because of its thick oscular tubes and strongly spined surface.

The polymorphism of the species, as discussed by Burton (1934a: 543) and Bergquist and Warne (1980: 28), is here accepted, with the reservations and additions given above. The erect branching habit of the new specimen is closest to *Pachychalina manus* (here figured for comparison, pl. 11 fig. 10), in which the branches are more prolific, with short, clavate ends. The variability, though to a lesser degree, also affects skeletal measurements (fibres, meshes, and spicules).

Callyspongia pergamentacea (Ridley)

Plate 12 figures 1–3, plate 31 figure 6,
plate 32 figure 1, text-figures 71–73

Provisional synonymy.

Cladochalina armigera var. *pergamentacea* Ridley, 1881: 112, pl. 10 fig. 4 (Hotspur Bank, Brazil).

Cladochalina armigera (nec Duchassaing and Michelotti).—Ridley, 1884a: 394 (Torres Strait; Port Denison, Qld).



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Figures 71, 72. *Callyspongia pergamentacea*. Details in reflected light, $\times 20.6$. Figure 71. View of surface. Figure 72. Perpendicular section (surface above).

Cladochalina pergamentacea.—Ridley, 1884a: 398 (Thursday Island, Torres Strait).

Chalina pergamentacea.—Ridley and Dendy, 1887: 27, pl. 5 fig. 2 (Bass Strait).—Dendy, 1895: 244 (Port Phillip Heads).

Ceraochalina pergamentacea.—Dendy, 1924: 327 (New Zealand).

Callyspongia pergamentacea.—Hechtel, 1976: 240, 249, 253 (Bahian region, Brazil).

Chalinopora paucispina Lendenfeld, 1887a: 765 (Queenscliff, Vic.).—Burton, 1934a: 603, 609 (as synonym of *Callyspongia ramosa*).

Cladochalina paucispina.—Burton, 1927a: 294 (transfer only).

Chalinopora typica Lendenfeld, 1887a: 765 (with var. *tenuispina* and var. *megarhaphis*, Port Jackson, NSW, and (unpublished) Port Phillip, Vic., and Kangaroo Island, SA).

Cladochalina typica.—Burton, 1927a (transfer only).

Ceraochalina papillata Lendenfeld, 1887a: 779f. (part, unwarranted collective replacement name for *armigera* sensu Schmidt and Ridley, var. *pergamentacea* Ridley; not varr. nov. *macropora*, *intermedia*, *micropora*).

Material examined. Station KG 1, one specimen (F52027). Type specimens of *Chalinopora paucispina* and *Chalinopora typica* (AM, BMNH). Hypotypes of *Cladochalina armigera*, *Cladochalina pergamentacea*: Ridley, 1884a (BMNH); of *Chalina pergamentacea*: Ridley and Dendy (BMNH), Dendy, 1895 (NMV).

Diagnosis. Irregularly ramose, branches knotty, lobate, or compressed, occasionally flabellate. Spongy, light and very compressible when dry. Yellowish beige to light red-purple in life. Oscules conspicuous, irregularly scattered. Surface smooth, parchment-like. Ectosomal reticulum thin, very dense. Main skeleton lax, irregular; fibres generally thin, with pale spongin, with spicular cores regular to semiplumose. Choanosome scanty, with smaller interstitial oxea.

Description. Erect-ramose with branches in a plane in irregular candelabrum-like fashion. Branches irregular, knotty, with bulbous excrescences, lacunose in one place, 4 to 15 mm thick. Specimen 10.5 cm high, 7 cm wide. Partly yellowish beige,

partly light red-purple in life, now yellowish beige (10 YR 8/4) throughout. Spongy, moderately firm in places. Few, irregularly scattered oscules, 0.5–2.5 mm wide, some slightly elevated. Surface smooth, parchment-like, irregularly speckled by subdermal vestibules. Fine ectosomal reticulum not always distinct with low magnification, partly masked by fine sediment.

In sections, primary meshes of ectosome triangular to polygonal, 400–800 μm wide, with fibres around 32 μm thick, cored to filled by 5–10 spicules abreast. Primary meshes profusely subdivided by thinner fibres, incompletely separated into secondaries, with 2–3 coring spicules, about 20 μm thick, and tertiaries with only one coring spicule, 10 μm and thinner. Smaller meshes 30–80 μm wide. Main skeleton lax, irregular, with primaries and secondaries commonly straggling, their spongin pale. In periphery (to 1–1.5 mm below surface), where ascending and transverse fibres are more distinct, primaries are 57–100 μm thick, with spacings 280–950 μm , frequently branch and form fascicles. Secondaries 35–45 μm thick, spaced 95–480 μm , occasionally branching and with free ends. In deeper portions, arrangement more irregular, with fibres frequently converging in knots. All fibres cored by oxea to half to two-thirds of diameter, some primaries filled. Arrangement of spicules often disheveled to semiplumose. Choanosome scanty, with numerous small oxea, distinctly fainter than those in fibres.

Spiculation: Fusiform oxea of the fibres, gently curved to bent, 67.6–71.9–80.2 \times 1.3–1.9–2.5 μm . Interstitial oxea, 38.8–58.1–67 μm long, below 1 μm thick.

Remarks. There is some similarity with *Callyspongia asparagus* in spicular dimensions and in the contrast between the lax main skeleton, with scanty flesh, and the dense ectosomal meshwork. The fibres in *C. asparagus* are more regularly arranged, straighter, generally thicker, darker in colour, and the spicules' density is much lower.

Callyspongia persculpta sp. nov.

Plate 12 figure 6, plate 33 figures 1–3,

text-figure 74

Holotype (?): F52035, station BSS 187 (38°32.0'S, 142°28.6'E, 17 km S of Warrnambool; depth 52 m, coarse sand and shells). It consists of two fragments believed to have been torn off a common base by the dredge.

Diagnosis. Ramose. Branches strongly sculptured, with spoon- or ear-shaped lobes concrescent in tiers. Rubbery, slippery, viscid; reddish brown in life. Surface microscopically smooth to granular. Small

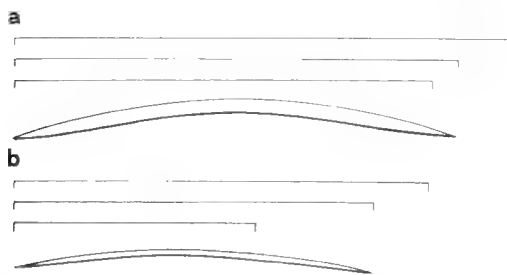


Figure 73. *Callyspongia pergamentacea*, spicules, $\times 777$. a. Oxea in fibres. b. Interstitial oxea.

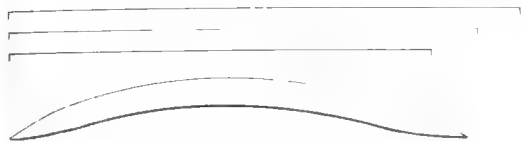


Figure 74. *Callyspongia persculpta* sp. nov., oxea, $\times 877$.

oscles in convex portions of lobes, concavities inhalant. Ectosomal reticulum deep, regularly condensed, umbellate and cancellate. Erect spicular penicils at surface commonly enveloped by fleshy dermis. Main skeleton generally regular, with variable spicular cores in all fibres. Choanosome fairly dense, with numerous interstitial oxea not different in size from those in fibres.

Description. Two fragments, of slightly unequal size, conspicuously ornamented, roughly club-shaped, subdivided into tiers of con crescent hollow lobes with sharp, upturned rims. Composite excrescences about 1.5 cm apart, tilted outward and sideways from axis of each branch. Each branch slightly depressed overall, scooping shallower, more irregular along proximal broadside. Some scooped tiers on distal side like human ears. Lengths of branches 8 and 10 cm, width (along tiers), 3–5.5 cm, depths (across tiers), 1.5–3 cm. Individual hollow lobes 8–15 mm wide, 5 mm deep, with walls 2–3 mm thick distally. Reddish brown in life, partly preserved in alcohol (10 R 5–6/4), partly faded to greyish fawn (7.5 YR 6–7/4). Rubbery, slippery, viscid. Convex, often slightly rugose and verrucose outer and lower sides of scooped tiers exhalant, with regularly scattered small oscles, 0.5–1.5 mm wide, 3–6 mm apart, with rims mostly flush, occasionally slightly raised. Surface finely granulate at intermediate magnification. Inhalant concavities speckled to unaided eye by numerous vestibules, with fine ostia in meandering, anastomosing lines, occasionally in vaguely stellate fashion.

Moderately dense choanosome with rounded-lacunose canal system. Ascending fibres distinct, commonly straggling, frequently branching in mesial zone of lobe wall, closer to inner, concave surface, curving to both sides to meet surfaces perpendicularly. Meshwork irregular, with connecting fibres and scarce intercalated primaries generally oblique.

Ectosomal reticulation about 140 μm thick, conspicuously condensed, by prolific branching of primaries, and by closely spaced secondaries, from which additional short intercalated primaries may issue. Mesh sizes 33–123 μm . All radial spicule-cores expand just below surface, like brushes, at times forming palisades. Coriaceous, finely fibrous dermis (brown in transmitted light) overlying

peripheral spicule brushes, or with enclosed brushes ending flush, occasionally echinating. Two condensed zones curving in abruptly from inner surface below rim, parallel with outer surface, being overgrown earlier surfaces, both thicker (290 μm) than present ectosome. Main skeleton between these three zones more regular than that below. In deeper main skeleton, primaries have diameters of 17–44 μm , and are cored to variable extent, mostly between one-to two-thirds of diameter (2–10 spicules abreast); spacing 100–455 μm . Secondaries 14–32 μm thick, spaced 105–520 μm , frequently cored by 1–2 spicules. Many spicules scattered interstitially, also between three condensed zones.

Spiculation: oxea, hastate, rarely fusiform, straight or curved, 60–66.7–72.6 \times 2–3.2–4.4 μm .

Remarks. The only fractures visible are on the inside of the first tier of each branch. They are similar but do not match. If the branches are held with opposite facing fractures and with the rims of all tiers approximately horizontal, inferring position in life, it is likely that the support was elevated, perhaps a stalk or large shell, and that the branches were drooping at a 45° angle, proximally opposite, distally slightly converging.

This species is somewhat atypical for *Callyspongia* in its ectosomal structure. The condensation is very pronounced, with prolific branching of primaries just below the surface, and spicular brushes throughout the surface more crowded than usual in species formerly assigned to *Ceraochalina* and *Euplacella*. The similarity of this type of ectosome with that of *Cribrochalina* is more pronounced in this species than in *Callyspongia bilamellata*, where the crowding of erect penicils occurs only in some areas of the surface. In *Cribrochalina*, however, anastomoses (secondaries) are much less in evidence, particularly in the main skeleton. Another atypical trait of this species is the unusually thick collagenous dermis enveloping most of the spicular brushes. The new species is comparable, in several points, with *Spongia crassiloba* Lamarck, 1814, as redescribed by Topsent (1930a: 21, pl. 2 figs 4–5; as *Chalina crassiloba*), which also came from Bass Strait (King Island). This also has ear-shaped bifacial lobes (with inhalant and exhalant sides) of firm texture, has a strongly condensed skeleton at the surface, with analogous zones internally (overgrown earlier surfaces), and hastate oxea of similar dimensions to those of *Callyspongia persculpta*. The lobes in Lamarck's only type specimen are much larger than in *C. persculpta*, erect and mostly free, con crescent below in a massive base. Its oscles are wider

than in the new species, more crowded and conspicuous, especially on the wide margins of the lobes. Its main skeleton is apparently more regular, tighter than in *C. persculpta*, with rectangular meshes, their width generally exceeding their height. The chief difference is the great scarcity of spicules in the main skeleton of Lamarck's sponge: they occur in primaries only, forming discontinuous single rows. The peripheral skeleton, by contrast, is rich in spicules, but its structure is not quite clear from Topsent's description. Primaries are said to have spicular cores rapidly increasing in diameter below the surface, becoming packed distally (there is no mention of penicils, but primary tips are said to frequently stand out in relief), and secondaries forming the fairly wide meshes of the tangential superficial reticulum (on inhalant surfaces only?) are also charged with spicules. The specimen is dry, and any coriaceous ectosome possibly originally present (as in *C. persculpta*) might have vanished through natural maceration.

This insecurity makes the generic placement of *crassiloba* speculative. Van Soest (1980: 31) discussed it as a possible synonym of *Amphimedon complanata* (Duchassaing). I find this very unlikely.

Callyspongia ramosa (Gray)

Plate 11 figure 11, text-figure 75

Provisional synonymy.

Spongia ramosa Gray, 1843: 295 (part; New Zealand).

Pachychalina ramosa. — Dendy, 1898: 318, pl. 33 (part; redescription of 4 syntypes, including lectotype).

Callyspongia ramosa. — Burton, 1934a: 597, 603 (synonymy, diagnosis, résumés, revision, discussion of synonyms). — Burton, 1938: 20 (Tasmania). — Bergquist, 1961a: 36 (New Zealand). — Bergquist and Warne, 1980: 30, pls 14f, 15a–f (synonymy, description, discussion, distribution, New Zealand).

Cladochalina nuda Ridley, 1884a: 395, pl. 41 fig. i (Torres Strait). — Burton, 1934a: 609 (comment on holotype).

Cladochalina nuda var. *abruptispicula* Ridley, 1884a: 396, pl. 41 fig. j (Torres Strait). — Burton, 1934a: 609 (comment on holotype).

Ceraoachalina nuda. — Lendenfeld, 1887a: 781 (with varr. *oxyus* and *oxystrongylus*, nomina vana).

Chalina nuda. — Hentschel, 1912: 397 (Aru Islands, Indonesia).

Chalina polychotoma (nec Esper): Carter, 1885d: 284

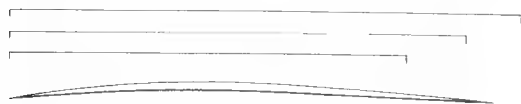


Figure 75. *Callyspongia ramosa*, oxea, $\times 734$.

(part: BMNH 1884.10.10.1 (dry) only; Port Phillip Heads). — ?Dendy, 1895: 243.

Chalina polychotoma var. *oculata* Carter, 1885d: 28 (part: BMNH 1886.12.15.152, — 153 only; Port Phillip Heads).

Chalina polychotoma var. *trichotoma* Carter, 1885d: 115. — Carter, 1885d: 284 (Port Phillip Heads).

Dactylochalina australis Lendenfeld, 1886f: 726 (part material from Port Phillip Bay and Port Jackson only, not from Western Australia). — Lendenfeld, 1887a: 813.

Cladochalina dendroides Lendenfeld, 1887a: 769, pl. 19 fig. 21 (Port Chalmers, New Zealand). — Burton, 1934a: 605 (syntype in BMNH redescribed).

Cladochalina mammillata Lendenfeld, 1887a: 769 (Port Chalmers, New Zealand). — Burton, 1934a: 605 (holotype redescribed).

Cladochalina tenuirhaphis Lendenfeld, 1887a: 769, pl. 19, fig. 24 (Port Chalmers, New Zealand). — Burton, 1934a: 606 (holotype redescribed).

Pachychalina paucispina Lendenfeld, 1887a: 776 (junior secondary homonym of *Chalinopora paucispina* Lendenfeld, 1887a; New Zealand). — Burton, 1934a: 606 (holotype redescribed).

Pachychalina ramulosa var. *lamella* Lendenfeld, 1887a: 777 (as *lamella*, junior secondary homonym of *Chalinopora lamella* Lendenfeld, 1887a; New Zealand). — Burton, 1934a: 606 (holotype redescribed).

Pachychalina ramulosa var. *digitata* Lendenfeld, 1887a: 777, pl. 19 fig. 22 (as *digitata*, junior secondary homonym of *Chalinissa communis digitata* Lendenfeld, 1887a; Port Chalmers, New Zealand). — Burton, 1934a: 606 (holotype redescribed).

Pachychalina macrospina Lendenfeld, 1887a: 777 (Port Chalmers, New Zealand). — Burton, 1934a: 606 (holotype redescribed), pl. 19 fig. 18 (junior secondary homonym of *Cladochalina elegans* Lendenfeld, 1887a; Port Chalmers, New Zealand). — Burton, 1934a: 606 (holotype redescribed).

Pachychalina rigida Lendenfeld, 1887a: 778, pl. 19 fig. 14 (junior secondary homonym of *Chalinissa rigida* Lendenfeld, 1887a; New Zealand). — Burton, 1934a: 607 (holotype redescribed).

Pachychalina oculata Lendenfeld, 1887a: 778 (junior secondary homonym of *Chalina polychotoma* var. *oculata* Carter; Mauritius). — Burton, 1934a: 608 (holotype redescribed).

Ceraoachalina papillata var. *macropora* Lendenfeld, 1887a: 780 (as *macropora*, junior secondary homonym of *Chalinella macropora* Lendenfeld, 1887a; New Zealand). — Burton, 1934a: 607 (lectotype in BMNH redescribed).

Ceraoachalina papillata var. *intermedia* Lendenfeld, 1887a: 781 (as *intermedia*, junior secondary homonym of *Siphonochalina intermedia* Ridley and Dendy, 1886; Port Chalmers, New Zealand). — Burton, 1934a: 607 (holotype redescribed).

Ceraoachalina papillata var. *micropora* Lendenfeld, 1887a: 781, pl. 19 fig. 16; Port Chalmers, New Zealand). — Burton, 1934a: 607 (holotype redescribed).

Ceraoachalina levis Lendenfeld, 1887a: 782, pl. 19 fig.

19 (Torres Strait; Port Chalmers, New Zealand). — Whitelegge, 1906: 406 (2 type slides in AM re-examined). — Burton, 1934a: 604 (lectotype and one paralectotype redescribed).

Ceraochalina microrhaphis Lendenfeld, 1887a: 783 (Port Chalmers, New Zealand). — Burton, 1934a: 607 (holotype redescribed).

Ceraochalina multiformis var. *maeandra* Lendenfeld, 1887a: 783 (Port Chalmers, New Zealand). — Burton, 1934a: 607 (holotype redescribed).

Ceraochalina multiformis var. *lamella* Lendenfeld, 1887a: 783, pl. 19 fig. 15, pl. 27 fig. 25 (as *lamella*, junior secondary homonym of *Chalinopora lamella* Lendenfeld, 1887a; New Zealand). — Burton, 1934a: 607 (holotype redescribed).

Ceraochalina multiformis var. *elegans* Lendenfeld, 1887a: 784, pl. 19 fig. 23; pl. 27 fig. 4 (as *elegans*, junior secondary homonym of *Cladochalina elegans* Lendenfeld, 1887a; Westernport Bay, Vic.).

Ceraochalina multiformis var. *digitata* Lendenfeld, 1887a: 784, pl. 19 fig. 20 (part: not syntype from Port Jackson; as *digitata*, junior secondary homonym of *Chalinissa communis digitata* Lendenfeld, 1887a; Port Chalmers and Chatham Island, New Zealand). — Burton, 1934a: 607 (syntypes from New Zealand redescribed).

Ceraochalina multiformis var. *mollis* Lendenfeld, 1887a: 784 (as *mollis*, junior secondary homonym of *Cladochalina mollis* Lendenfeld, 1887a; Port Chalmers, New Zealand). — Burton, 1934a: 608 (holotype redescribed).

Ceraochalina multiformis var. *dura* Lendenfeld, 1887a: 784, pl. 19 fig. 25 (Port Chalmers, New Zealand). — Burton, 1934a: 608 (syntype in BMNH redescribed).

Ceraochalina reteplax Lendenfeld, 1887a: 785, pl. 19 fig. 17 (Port Chalmers, New Zealand). — Burton, 1934a: 608 (holotype redescribed).

Ceraochalina tenella Lendenfeld, 1887a: 785 (junior secondary homonym of *Chalinella tenella* Lendenfeld, 1887a; Port Phillip Bay, Vic.).

Ceraochalina euplax Lendenfeld, 1887a: 785, pl. 19 fig. 13 (junior secondary homonym of *Cladochalina euplax* Lendenfeld, 1887a; New Zealand). — Burton, 1934a: 608 (holotype redescribed).

Ceraochalina extrema Lendenfeld, 1887a: 785 (Port Chalmers, New Zealand). — Burton, 1934a: 608 (holotype redescribed).

Dactylochalina mollis Lendenfeld, 1887a: 812 (junior secondary homonym of *Cladochalina mollis* Lendenfeld, 1887a; east coast). — Lendenfeld, 1888: 100.

Dactylochalina candelabrum Lendenfeld, 1887a: 812 (Port Chalmers, New Zealand). — Burton, 1934a: 608 (holotype redescribed).

Dactylochalina conulata Lendenfeld, 1887a: 813, pl. 18 fig. 2 (junior secondary homonym of *Chalinopora conulata* Lendenfeld, 1887a; Port Jackson, NSW).

Euchalinopsis dendroides Lendenfeld, 1887a: 816, pl. 18 fig. 8 (junior secondary homonym of *Cladochalina dendroides* Lendenfeld, 1887a; Illawarra and Port Jackson, NSW).

Euchalinopsis minima Lendenfeld, 1887a: 816, pl. 18

fig. 3 (Port Jackson, NSW, Port Phillip Bay, Vic.; Torres Strait, Qld; Port Chalmers, New Zealand). — Burton, 1934a: 608 (syntypes from Port Chalmers, Port Phillip and Torres Strait redescribed).

Euchalina typica Lendenfeld, 1887a: 817, pl. 18 fig. 5, pl. 27 fig. 24 (junior secondary homonym of *Chalinopora typica* Lendenfeld, 1887a; Port Jackson, NSW; Western Australia; New Zealand).

Euchalina paucispina Lendenfeld, 1887a: 818, (junior secondary homonym of *Chalinopora paucispina* Lendenfeld, 1887a; Port Jackson, NSW; Port Phillip Bay, Vic.; Port Chalmers, New Zealand). — Burton, 1934a: 608 (lectotype and paralectotypes described).

Euchalina macropora Lendenfeld, 1887a: 818 (junior secondary homonym of *Chalinissa macropora* Lendenfeld, 1887a; Port Jackson, NSW).

Chalina macropora. — Whitelegge, 1906: 454 (type slide in AM re-examined, new record off Crookhaven River, NSW).

Euchalina phillippinensis Lendenfeld, 1887a: 819 (spelled *philippensis* on p. 757; Port Phillip Bay, Vic.; New Zealand).

Dactylochalina monilata (nec Ridley, 1884a). — Lendenfeld, 1888: 100 (part: Lendenfeld's material only, identical with syntypes of *Dactylochalina australis*; Port Jackson). — Whitelegge, 1889: 183 (off Green Point, Port Jackson).

Phyllospongia (*Antheroplax*) *perforata* (nec Hyatt, 1877). — Lendenfeld, 1889b: 172 (part: dry specimen from New Zealand, BMNH 1886.8.27.46, only, — slide AM G3711).

?*Pachychalina densa* Brøndsted, 1923: 125, text-fig. 7 (Auckland Islands, New Zealand).

Gelliodes flagelliformis Brøndsted, 1923: 129, text-fig. 10 (Auckland Islands, New Zealand).

Gelliodes filiformis Brøndsted, 1923: 131, text-figs. 12, 13 (Campbell Islands, New Zealand).

Toxochalina difficilis Brøndsted, 1923: 132, text-fig. 14 (Auckland Islands, New Zealand).

?*Gelliodes biformis* Brøndsted, 1923: 449, text-fig. 8 (New Zealand).

Pachychalina affinis Brøndsted, 1924: 455, text-fig. 13 (New Zealand).

?*Pachychalina lunae* Brøndsted, 1924: 455 text-fig. 13 (New Zealand).

Material examined. Station BSS 180, one specimen (F52028). Syntypes of *Spongia ramosa* Gray (BMNH only). Type specimens of *Chalina polychotoma* varr. *oculata*, *trichotoma* Carter (BMNH), of *Dactylochalina australis*, *Cladochalina dendroides*, *C. mamillata*, *C. tenuirhaphis*, *Pachychalina paucispina*, *P. ramulosa* varr. *lamella*, *digitata*, *P. macrospina*, *P. elegans*, *P. rigida*, *Ceraochalina papillata* varr. *macropora*, *intermedia*, *micropora*, *C. levis*, *C. microrhaphis*, *C. multiformis* varr. *maeandra*, *lamella*, *elegans*, *digitata*, *mollis*, *dura*, *C. reteplax*, *C. tenella*, *C. euplax*, *C. extrema*, *Dactylochalina mollis*, *D. candelabrum*, *D. conulata*, *Euchalinopsis dendroides*, *E. minima*, *Euchalina typica*, *E. paucispina*, *E. macropora*, *E. phillippinensis* Lendenfeld (AM and BMNH). Hypotypes of *Chalina polychotoma*:

Carter, 1885d (BMNH), and of *Phyllospongia perforata*: Lendenfeld, 1889b (BMNH).

Diagnosis. Ramose, erect; branches terete or compressed, solid or tubular; occasionally encrusting, with oscular processes. Firmly spongy, occasionally soft or almost incompressible. Mauve or dull yellow in life. Surface generally smooth, even, locally microconulose. Oscules numerous, scattered or in lines, flush or raised. Ectosomal skeleton variably condensed or paratangential, subdivision not always distinct, may be locally absent. Erect spicular brushes may be present at surface. Main skeleton mostly regular, rectangular, primaries and most secondaries regularly cored by oxea, but fibre thickness and proportion of spongin varies. Oxea variable, especially in thickness, may also occur interstitially in choanosome of variable density. Toxa may be present in variable proportions.

Description. Single compressed branch, regularly expanding to spatulate end asymmetrically cleaved by two notches, one 6 mm deep, other 1 mm. Branchlet, 1 cm long, issuing from base. Main branch proximally terete, 4 mm thick, soon compressed, expanding from 3–4 mm to 15 mm at end. Total height 7 cm.

Pale ochre in life (10 YR 6/6), now slightly faded. Softly spongy, limp. Oscules numerous, 0.3–1 mm wide, round to elongate, irregularly scattered along both narrow sides and one of faces. Surface smooth optically, microconulose at intermediate magnification. Vestibules only apparent from outside in upper half of main branch. Ectosomal reticulum poorly defined even at intermediate magnification, masked by dermis and ill-sorted sediment.

Meshwork of main skeleton regular, though primaries and secondaries generally sinuous. Peripheral skeleton moderately condensed, by crowding of secondaries and by adventitious primaries beginning from fourth to second secondary fibre below surface, but also from outermost ones. All primaries have short, conical free ends of unequal length, rudimentary to about 100 μm . Tips of conules frequently rugged, truncate, with spicules occasionally protruding. Primaries below periphery 26–45 μm thick, spaced 240–380 μm . Secondaries of deeper portions 23–36 μm thick, 175–350 μm apart. Meshes in periphery generally about one-half width of deeper ones. Primary fibres commonly cored by about 6 spicules abreast, secondaries by 1–3 spicules. Cores and alignment of spicules well defined. Numerous spicules strewn interstitially in dense and pervasive choanosome, like ill-sorted sediment and few foreign spicules.

Spiculation: Weak fusiform oxea with indistinct

ends, straight to irregularly bent or flexuous, 67–77–86.5 \times 1.4–1.7–2.6 μm .

Remarks. The synonymy suggested above is largely that of Burton (1934a: 603), with some exceptions concerning records outside New Zealand waters. *Euchalina exigua* Lendenfeld (1887a), with its varieties, is here accepted as a good species of *Callyspongia*. *Chalinopora paucispina* Lendenfeld is here regarded as a junior synonym of *Callyspongia pergamentacea* (see above). *Chalina oculata novaezealandiae* Dendy (1924) is, in my opinion, a synonym of *Callyspongia serpentina* (see below). Topsent's (1933) revision of *Spongia serpentina* Lamarck apparently came to Burton's attention too late, and he (1934a: 598), like Topsent, accepted Lendenfeld's epithet *communis* as valid. Both *Callyspongia ramosa* and *C. serpentina* seem to be fairly common in Bass Strait, and, overlapping in several traits, were easily confused in the past. This is apparent in *Chalina polychotoma*: Carter, with its varieties (all merged by Dendy, 1895: 243), which comprises specimens of both species; but also in the revisions of the type series (different parts thereof in Dendy, 1898, and Burton, 1934a) of *Spongia ramosa* Gray, in which two of the seven syntypes probably belong to *C. serpentina*.

The oxea in both species are very similar in range of shapes and dimensions. There is also, occasionally, in both species, a more or less pronounced segregation of thick and thin oxea, thick ones in *C. ramosa* being hastate with abrupt points, and generally more common. The new specimen of *C. ramosa* is atypical in having only thin fusiform oxea. Of the specimens redescribed as synonyms of *C. ramosa* by Burton (1934a), one, the syntype of *Ceraochalina levis* Lendenfeld from Torres Strait, agrees with the present specimen in this respect, except for possessing rare oxea of the normal, stout kind. Bergquist and Warne (1980: 31) noted an inverse relationship between volume of spongin (fibre thickness) and spicule size in their numerous specimens. The present specimen, with relatively thin fibres, does not seem to fit this state.

Burton's (1934a) synonymy was accepted by Bergquist and Warne (1980), who noted great morphological variability in their material, externally and in skeletal features. They noted toxa in only one specimen. The great variability in frequency of toxa in *Callyspongia toxifera* (see below) supports Burton's view that the presence of toxa has no importance in *C. ramosa*.

Beyond differences in habit (branches generally smooth in *C. ramosa*, knotty and rugose in *C. serpentina*) and in structure of the main skeleton (perhaps to be found less pronounced once all types of synonyms of both sibling species are critically

re-examined), the chief diagnostic trait seems to be the distinctly higher condensation in the ectosomal skeleton of *C. serpentina*. In both species, however, the condition of the surface is intermediate between that of *Callyspongia* (nominotypical subgenus sensu van Soest, 1980) and subgenus *C. (Euplacella)* sensu van Soest, 1980, 1982, correctly *Ceraochalina*): the conules of spongin cored by oxea are obviously homologous with naked spicule-brushes, and the latter seem to occur occasionally in both sibling species. The specific identities of *Ceraochalina pergamentacea* (nec Ridley): Dendy, 1924, and of *Cladochalina dendyi* Burton, 1929a (both cited in Burton's synonymy of 1934a) are impossible to ascertain on the basis of their descriptions.

Callyspongia serpentina (Lamarek)

Plate 12 figure 4, plate 32 figures 2–4,

text-figure 76

Provisional synonymy.

Spongia serpentina Lamarek, 1814 (1813–1814): 452 (with var. β ; King Island, Bass Strait, Tasmania. Redescribed by Topsent, 1933: 2).

Chalina polychotoma (Esper) var. *oculata* Carter, 1885d: 284 (part: BMNH 1886.12.15.154, -156 only; Port Phillip Heads, Vic.).

Chalina polychotoma var. *moniliformis* Carter, 1885d: 285 (south coast of Australia).

Chalina polychotoma var. *angulata* Carter, 1885d: 285 (Port Phillip Heads, Vic.).

Pachychalina elongata Ridley and Dendy, 1886: 329. – Ridley and Dendy, 1887: 23, pl. 6 fig. 1 (off Moncoeur Island, Bass Strait, Tas.).

Cladochalina elongata. – Burton, 1927a: 508, 510 (transfer).

Euplacella elongata. – Burton, 1934a: 597 (transfer only).

Chalinissa communis Lendenfeld, 1887a: 772 (collective name for following varieties, no nominotypical subspecies; junior secondary homonym of *Tubulodigitus communis* Carter, 1881a). – Lendenfeld, 1888: 87, pl. 8 (Port Jackson). – Whitelegge, 1902b: 278, 286 (syntype in AM and type slide of var. *flabellum* ex BMNH re-examined).

Chalinissa communis var. *flabellum* Lendenfeld, 1887a:

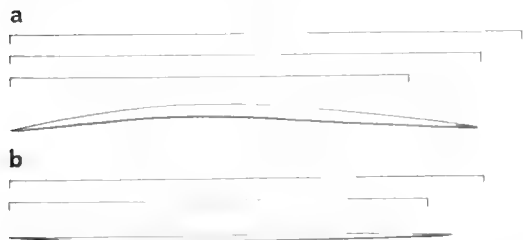


Figure 76. *Callyspongia serpentina*, spicules, $\times 1059$. a. Oxea in fibres. b. Interstitial oxea.

772, pl. 20 fig. 32; pl. 27 figs 5, 11, 13, 15 (Port Jackson, NSW). – Lendenfeld, 1888: 8. – Whitelegge, 1889: 182 (off Green Point, Port Jackson).

Chalinissa communis var. *digitata* Lendenfeld, 1887a: 772, pl. 20 fig. 30 (Port Jackson, NSW).

Pachychalina communis. – Whitelegge, 1901: 70 (synonymy; Tuggerah Beach, NSW). – Whitelegge, 1906: 458 (varr. *flabellum* and *digitata*, *Chalinissa elegans*, *C. elongata*, *C. tenuifibris*, *C. serpens* Lendenfeld merged, all types re-examined, spicule dimensions; coast of NSW, common).

Cladochalina communis. – Burton, 1927a: 504, 505 (transfer, the 2 varieties merged). – Topsent, 1933: 2, pl. 1 figs 5, 6 (2 syntypes of typical var. and var. β of *Spongia serpentina* redescribed).

Euplacella communis. – Burton, 1934a: 598 (transfer, synonymy; Great Barrier Reef).

Chalinissa macropora Lendenfeld, 1887a: 772, pl. 20 fig. 28 (Port Jackson, NSW).

Cladochalina macropora. – Burton, 1927a: 504, 505 (transfer).

Chalinissa tenuifibris Lendenfeld, 1887a: 773, pl. 20 fig. 29 (Port Jackson, NSW).

Cladochalina tenuifibris. – Burton, 1927a: 504, 505 (transfer, possibly synonym of *C. communis*).

Chalinissa serpens Lendenfeld, 1887a: 773, pl. 20 fig. 33 (east coast of Australia). – Burton, 1927a: 504, 505 (synonymised with *Cladochalina communis*).

Chalinissa elegans Lendenfeld, 1887a: 773, pl. 20 fig. 27 (junior secondary homonym of *Cladochalina elegans* Lendenfeld, 1887a; Broughton Island, NSW). – Lendenfeld, 1888: 87 (Illawarra, NSW). – Whitelegge, 1902b: 278, 286 (2 syntypes re-examined). – Burton, 1927a: 504, 505 (synonymised with *Cladochalina communis*).

Chalinissa rigida Lendenfeld, 1887a: 773 (Port Jackson, NSW). – Burton, 1927a: 504, 505 (synonymised with *Cladochalina communis*).

Chalinissa elongata Lendenfeld, 1887a: 774, pl. 20 fig. 34 (Illawarra, NSW). – Lendenfeld, 1888: 87. – Whitelegge, 1902b: 278, 286 (AM-type slide ex BMNH-syntype re-examined). – Burton, 1927a: 504, 505 (synonymised with *Cladochalina communis*).

Chalinissa ramosa Lendenfeld, 1887a: 774, pl. 20 fig. 31 (Port Jackson). – Burton, 1927a: 504, 505, 510 (synonymised with *Cladochalina communis*).

Pachychalina ramosa. – Whitelegge, 1906: 455 (off Wata Mooli, off Coogee, off Wollongong, off Shoalhaven Bight, NSW).

Ceraochalina typica Lendenfeld, 1887a: 782, pl. 19 fig. 26 (Port Phillip Bay, Vic.).

Chalina oculata var. *novaezealandiae* Dendy, 1924: 326 (New Zealand).

?*Cladochalina dendyi* Burton, 1929a: 421 (Victoria Land, New Zealand's Antarctic Territory).

Material examined. Station KG 9, one specimen (F52029). Type specimens of *Chalina polychotoma* varr. *oculata*, *moniliformis*, *angulata* Carter, 1885d (BMNH), of *Pachychalina elongata* Ridley and Dendy (BMNH), of *Chalinissa communis* varr. *flabellum*, *digitata*, *C. macropora*, *C. tenuifibris*, *C. serpens*, *C. elegans*, *C. rigida*,

C. elongata, *C. ramosa*, *C. typica* Lendenfeld (AM and BMNH). Hypotypes of *Pachychalina ramosa*: Whitelegge, 1906 (AM).

Diagnosis. Ramose, erect. Branches irregular, knotty, angular, lobate, or compressed, occasionally frondose, often prolific. Firmly spongy, rubbery, viscid; fawn in life. Oscules numerous, scattered. Surface smooth, glabrous to microconulose. Ectosomal reticulum much condensed, chiefly irregular, with short echinating fibres. Choanosome cavernous, main skeleton very irregular. Indistinct primary fibres cored, but oxea often semiplumose. Many oxea interstitial, smaller.

Description. Prolifically branched, with 15 branches distally. Basal portion a palmate frond, 8 mm thick, 6.5 cm wide distally, 10 cm high, with cleft 6 cm long on one side. Few crooked, stubby branchlets from its sides and lower face. Remaining longer branches from upper face and edge of basal frond, straggling, knotty, compressed in different directions, of variable thickness, generally with angular cross-section. Angularity heightened by coarse pits and lacunae, often crowded with common margins forming rugo-reticulate pattern. Most branches only partly affected by this pattern, to variable degrees. Some branches more strongly compressed, flabellate, below bifurcation or multiple subdivision, partly also due to concrescence of contiguous branches. Most branches 0.6–1.5 cm wide, erect ones 10–21 cm high. Total height 31 cm.

Fawn in life (7.5 YR 7/6), now duller (10 YR 6–8/4). Firmly spongy, rubbery, viscid, residual mucus upon handling difficult to wash away. Oscules numerous, scattered all over, 1–3 mm wide, round. Surface, except pitted areas, smooth, glabrous, also on branch tips. Many areas show dense, fine, weak speckling by vestibules. Very dense ectosomal reticulum with minute conules visible only at intermediate magnification. No clear distinction of primary and secondary tangential fibres.

Choanosome regularly cavernous, riddled by canals 0.5–0.8 mm wide, fleshy interstices containing numerous weak oxea. Main skeleton quite irregular. Little distinction between primary and secondary fibres, but former contain more spicules, commonly 2–6 abreast, are more flexuous, frequently fasciculate, and prolifically branched. Spicules in primaries aligned and coring, but frequently disheveled, semiplumose. Secondaries may be devoid of spicules or contain a discontinuous core of one, rarely two spicules. No appreciable difference in thickness (about 25 μm) between primaries and secondaries. Orientation of both, except most of peripheral portion, random, mesh sizes variable (50–600 μm).

Ectosomal skeleton much condensed, meshsizes around 60 μm . Cubic arrangement frequently obscured by oblique and branching fibres. Thinner fibres without order. Fibrous conules at surface short, generally below 30 μm , around 60 μm apart, cored by 1–3 broken spicules. Most echinating conules between nodes of reticulum. Tips of primaries mostly blunt, bifid or T-shaped. Ectosome contains variously abundant foreign detritus (sand grains, flocculent sediment, spicules and their fragments). Foreign matter scanty in choanosome.

Spiculation: Fusiform oxea of fibres, rarely straight, commonly asymmetrically bent, often broken, 46.5–54.7–59.8 \times 1.6–2–2.6 μm . Interstitial oxea, 48.7–55.3 \times 0.8–1.2 μm .

Remarks. The two syntypes of *Spongia serpentina* Lamarck (typical variety), as redescribed by Topsent (1933: 2), are beach-worn specimens in which the ectosome is mostly gone. The type of var. β (Topsent, 1933, pl. 1 fig. 6) is better preserved, but Topsent unfortunately neglected to describe its ectosome. However, the shape of the two figured specimens, Topsent's identification and comparison with *Chalinissa communis* as redescribed by Whitelegge, 1906, and the frequently semiplumose arrangement of oxea in primary fibres, leave no doubt that *S. serpentina* is the oldest available name of this species.

Through the type specimens listed above, I find the polymorphism confirmed, which was noted by Whitelegge (1906) and Burton (1927a), and which is apparent in the figures cited above in synonymy. Detailed descriptions of skeletal structure are so far scanty and inadequate. Whitelegge (1906: 459) merely noted that the extreme variability also affects the fibrous skeleton and the spicules. He was not clear on the structure of the ectosome, remarking that it is "velvet-like in appearance, and coated with a thin crust of oxoote spicules; the latter are very closely arranged and partly conceal the dermal network as well as the pores, which are scarcely visible to the unaided eye." It seems likely that this refers to naked spicular brushes homologous to the spongin-conules in the new specimen. Topsent described the oxea in the fibres of the type material of *Spongia serpentina* as fairly stout, barely fusiform with short conical points, measuring 70–85 \times 4–6 μm ; interstitial oxea as more fusiform, always weaker, 70 \times 1.5 μm . Spicular measurements given by Whitelegge (1906) for the types of *Chalinissa communis* and of the synonyms recognised by him have a range of 60–80 \times 4.5–6.5 μm for oxea in the fibres, 60 \times 2 μm for interstitial oxea (in *communis* only). The principal oxea in the new specimen are smaller, but hardly signifi-

cantly so, considering the analogous case in the new specimen of *Callyspongia ramosa*.

***Callyspongia toxifera* sp. nov.**

Plate 12 figure 5, plate 32 figures 5–6,

text-figure 77

Holotype: F52032, station BSS 181 (38°39.8'S, 144°18.2'E, 30 km SE of Lorne; depth 79 m, very fine sand with chaetopterid worm tubes). Three paratypes: F52030, station BSS 179 (39°03.2'S, 146°39.5'E, E of Wilsons Promontory; depth 55 m, muddy sand); F52031 and F52033, station BSS 181.

Diagnosis. Small, sparsely branched. Branches thin, straggling. Soft, limp; greyish yellow in life. Oscules minute, irregularly scattered or in lines. Surface smooth, microconulose. Ectosomal reticulum or condensation rudimentary. Main skeleton irregular, with weak, pale spongin fibres without oxea. Proper spicules only interstitial toxa of variable frequency. Scattered foreign detritus in choanosome.

Description. All specimens small. Holotype (pl. 12 fig. 5) consists of many thin branches, straggling, twisted and crooked to folded, mostly compressed in different directions, occasionally conrescent. Individual branches 1.5–3 mm wide, up to 4 cm long, sparingly subdivided, distally simple, slightly clavate, or compressed and bifid.

F52030 a single, fairly straight branch, 7.5 cm long, irregularly compressed, mostly around 5 mm wide, distally bifid, with tapering subdivisions 8 and 12 mm long. F52031 part of small group of branchlets, no longer than 1.5 cm, attached to chaetopterid worm tube with other sponges. Branchlets similar to smaller ones in holotype. F52033 of size intermediate between F52031 and holotype, more regularly subdivided, chiefly dichotomous. Distance between bifurcations 4 to 8 mm. F52030 greyish yellow (2.5 Y 7–8/4) in life, unchanged in alcohol. Other specimens now lighter, pale beige to cream. Soft, limp, easily torn. Oscules inconspicuous and minute, irregularly scattered, except F52030, where more conspicuous, 1–1.5 mm wide, regularly aligned on two narrow sides.

Surface smooth to unaided eye. With low magnification, regularly conulose, lower conules proximal, higher ones distal. In three specimens with thin branches, ectosomal reticulum rudimentary, undulating. In F52030, tangential reticulum at surface, between very low conules, meshwork distinctly finer than inside. Its distal secondary branchlets like thinly branched specimens in surface. Main skeleton an irregular meshwork of clear, pale, weak spongin fibres, always free of proper spicules and foreign inclusions. Commonly no distinction of primaries and secondaries, all fibres sinuous to crooked, occasionally bent at almost right angles, 12 to 26 μ m thick, swelling and tapering profusely, enclosing randomly oriented, twisted meshes 120–330 μ m wide. Some primaries vaguely distinct by radial orientation and more crooked course. In F52031, meshwork denser than in other specimens, with more uniform meshsizes.

Peripheral condensation absent or slightly developed, with more regular meshes subparallel with surface, and thinner fibres (around 8 μ m). Conules of variable elevation frequently oblique and crooked, with tapering tips of primary fibres, some issuing from vertical intercalations in outermost meshes, or directly from outermost tangential fibre.

Content of foreign debris scattered throughout the choanosme variable: coarse lithic fragments, foreign spicules (various megascleres and their fragments, microscleres), and fine sediment, the latter most variable in abundance. Toxa, though proper, also variable in frequency, evenly scattered interstitially; lacking in F52030, scarce in F52031, moderately frequent in F52032, frequent in F52033.

Spiculation: Frail toxa of variable size and angle, with narrow median bend and gentler distal recurvatures, thighs stiff, forming angles between 110° and 160°; length (chord) 25.6–65.2–89.4 μ m, thickness 0.8–1.7 μ m.

Niphatidae van Soest, 1980

***Gelliodes* Ridley**

Gelliodes Ridley, 1884a: 426. – Ridley and Dendy, 1887: 47 (new diagnosis). – Dendy, 1905: 137 (definition). – de Laubenfels, 1936a: 53 (definition in Desmacidonidae, revision). – Van Soest, 1980: 106 (definition in Niphatidae). – Desqueyroux-Faundez, 1984: 779f. (definition in Niphatidae, description of 4 species).

Diagnosis. "Niphatidae in which the tangential ectosomal reticulation is [often] obscured by protruding tufts of the choanosomal primaries, producing a rough conulose surface. Spongin present. Secondary fibres largely reduced. Microscleres abundant sigmata." (Van Soest, 1980:

Figure 77. *Callyspongia toxifera* sp. nov. Toxa from F52033, $\times 709$.

106.) Proportion of spicules to spongin highly variable. The surface, in some species, may be almost smooth. The fibrous skeleton, or portions thereof, may be isodictyal.

***Gelliodes incrustans* Dendy**

Plate 2 figure 2, plate 12 figure 7,
plate 33 figures 4–6, plate 34 figure 1,
text-figures 78–81

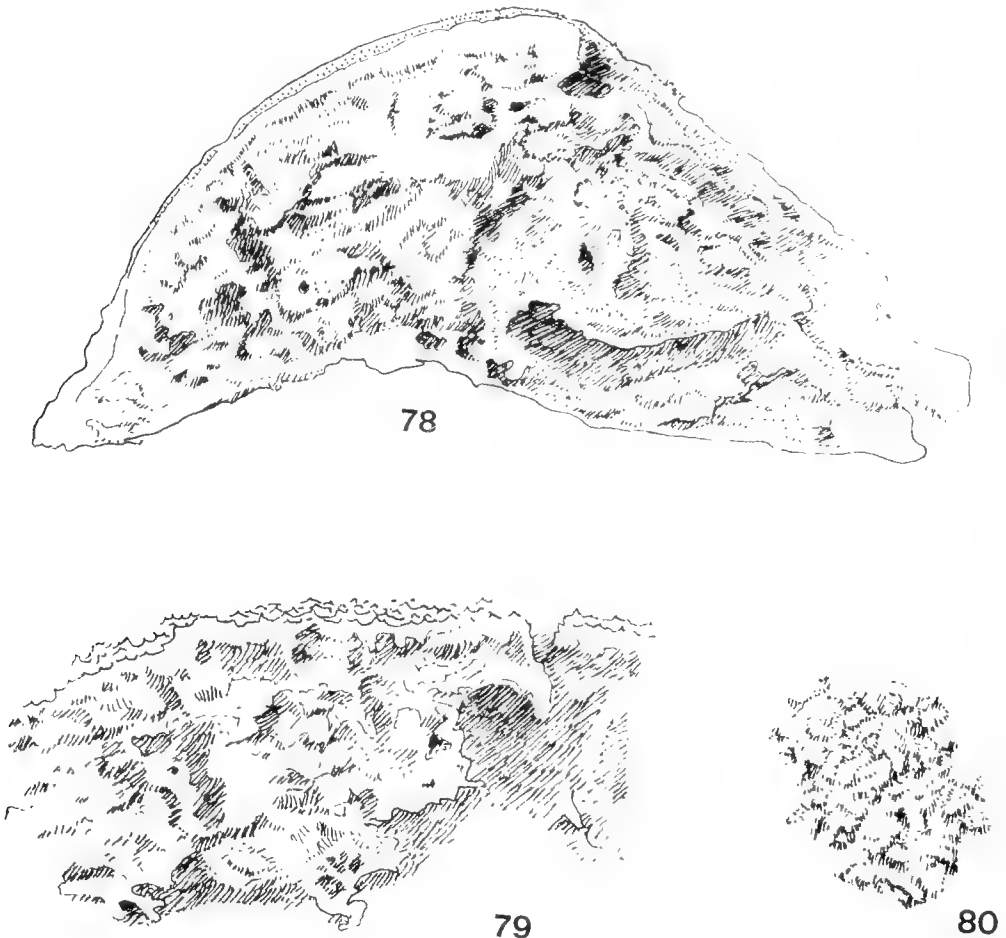
Gelliodes incrustans Dendy, 1905: 137, pl. 9 fig. 6 (Sri Lanka).—Lévi, 1965a: 20, fig. 25 (Red Sea).—Desqueyroux-Faundez, 1984: 782, figs 7, 53, 62, 63 (New Caledonia).

Material examined. Station KG 1 (one specimen, F52036).

Diagnosis. Small, encrusting to cushion-shaped,

often epibiotic. Compressible, resilient; light yellow to whitish, or greyish purple in life. Surface velvety, microconulose. Oscules round, 2–3 mm wide, flush or raised. Conspicuous meandering vestibules. Choanosome cavernous. Main skeleton irregular, with little differentiated primary spongin fibres cored by several oxea, often in semiplumose arrangement; secondaries with single oxea. Peripheral skeleton may be tighter, almost isodictyal. Oxea also interstitial, with numerous sigmata, foreign detritus and microsymbionts.

Description. Sponge now dissected, originally ovoid, slightly compressed, small, attached to side of *Jaspis stellifera* (described above), 1.7 × 2 cm wide at base, 8 mm high. In growth position, with mouth of larger vermetid proximally encrusted by *Jaspis stellifera* on top, narrower, almost conical



Figures 78–80. *Gelliodes incrustans*. Details in reflected light. Figure 78. Median sagittal section of whole specimen, × 6.6. Figure 79. Surface (above) and periphery, × 20.5. Figure 80. View of surface showing the pattern of subdermal canals, × 20.5.

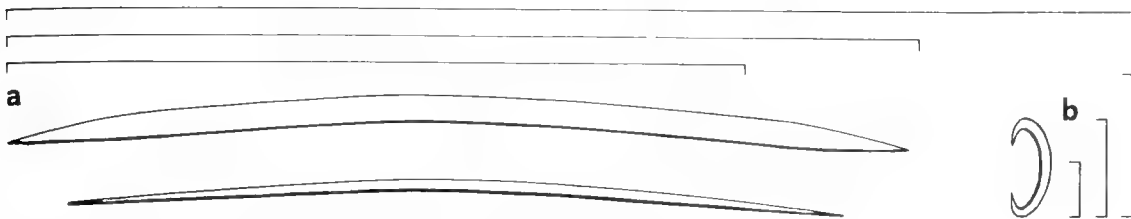


Figure 81. *Gelliodes incrustans*, spicules, $\times 979$. a. Oxea. b. Sigmata.

half of *Gelliodes*, still in place, directed upwards, bears apical, sharp-rimmed oscule, 2 mm wide.

Colour in life not recorded, now, in alcohol, pale fawn to dark beige (5 YR 7-8/4). Compressible, resilient, velvety surface. Weakly undulating surface smooth to unaided eye, with meandering subdermal canals and vestibules barely visible. With low magnification, surface regularly and finely conulose to hispid, conules about $50\ \mu\text{m}$ high and $100\ \mu\text{m}$ apart. Tangential reticulum indistinct, mostly masked by sediment.

Choanosome cavernous, traversed in all directions by confluent, meandering canals of rounded section, $350\text{--}750\ \mu\text{m}$ wide. Main skeleton irregular, often obscured by much scattered to clustering detritus and macrosymbionts. Fine sediment dominates, especially at surface, over foraminifera and their debris, whole branches of bryozoans, and foreign spicules, chiefly triradiates, probably from neighbouring calcareous sponge *Aulorrhiza procumbens*. Spongin dominates in fibres. Structure of main skeleton variable, but with two types or zones: (1) Generally deeper inside with thicker fibres. Primary fibres indistinct, little oriented, slightly thicker, irregularly spaced, occasionally branching, with spicular cores fifth to third of diameters (2-5 spicules abreast, often broken), generally straggling; arrangement of spicules occasionally disheveled, semiplumose. Intervening secondary meshwork, generally with single coring spicules, highly irregular in meshsizes and orientation. (2) Generally below surface to variable depths (up to 1.5 mm), without apparent primaries, fibres mostly thinner, meshwork more regular, finer, almost isodictyal. Interstitial oxea in both zones.

Overall, fibre diameters $10\text{--}65\ \mu\text{m}$, average about $35\ \mu\text{m}$; meshsizes $68\text{--}285\ \mu\text{m}$ for inner zone, around $100\ \mu\text{m}$ for outer zone.

Spiculation: (1) Oxea, fusiform, straight to slightly curved, $93\text{--}115\text{--}142 \times 1.6\text{--}2.9\text{--}4.4\ \mu\text{m}$; (2) sigmata of variable curvature, occasionally conorted, fairly abundant, scattered to clustered interstitially, $6.8\text{--}12.3\text{--}17.9 \times 0.9\text{--}1.2\ \mu\text{m}$.

Remarks. Previous records were from the Gulf of Mannar (Dendy), the Red Sea (Lévi), and New Caledonia (Desqueyroux-Faundez, with synoptic table of skeletal measurements). The latter record is somewhat doubtful, as the sigmata are considerably larger ($50\text{--}90 \times 2\text{--}3\ \mu\text{m}$). My measurements agree well with those of Dendy and Lévi, except for the somewhat thicker oxea in the latter ($105\text{--}130 \times 5\text{--}8\ \mu\text{m}$). None of the former descriptions mention a differentiation of an outer main skeleton. Such a feature is described by Burton (1934a: 538, pl. 1 figs 1-7) for *Gelliodes pumilus* (Lendenfeld), but that outer skeleton (to a depth of $200\ \mu\text{m}$) is devoid of spongin. The inner, fibrous main skeleton is described as isodictyal. Most of Burton's specimens have a fairly smooth surface, but Lendenfeld's holotype (also figured) is coarsely conulose. The description of this species in van Soest (1982: 89, fig. 8) refers to an undifferentiated main skeleton with thick primaries and transverse thinner secondaries, both packed with spicules, oxea being larger than in *G. incrustans*. Of the massive-lobose species of *Gelliodes* with Indo-West Pacific records, three others have fairly smooth surface. *G. carnosus* Dendy (see Desqueyroux-Faundez, 1984: 779) and *G. fragilis* Desqueyroux-Faundez (1984: 782) both differ from the present species chiefly by higher proportion of spicules to spongin, and consecutively more rigid or more fragile consistency. *G. tenuirhabdus* Pulitzer-Finali (1982b: 112), known from a single specimen, seems to have a skeleton very similar to the one of the present specimen. But the proportion of spicules to spongin is even weaker in the former, and the oxea are thin ($100 \times 1.5\ \mu\text{m}$), almost strongyles, weakly mineralised. It could be argued that these are differences of degree, or of ecophenotypes, but more material from the Great Barrier Reef will have to be examined to decide whether *G. tenuirhabdus* is a synonym of *G. incrustans*.

Oceanapiidae van Soest, 1980

Synonym: Phloeodictyidae Carter, 1882.

Remarks. Phloeodictyidae was dropped from use

in taxonomy by Topsent (1928: 66; as *Phloeodictyinae*, in the sense of Ridley and Dendy, 1887), who then preferred to place *Phloeodictyon* (*Oceanapia*) in the Renierinae Ridley and Dendy. Carter's senior synonym has not been used since then. In my opinion, ICZN Article 40 does not apply in this case. Though van Soest (1980: 85, 96, 97) synonymised *Phloeodictyon* and *Oceanapia* and mentioned *Phloeodictyinae* in his historical survey, his formal erection of *Oceanapiidae* (same work, pp. 80, 114) is not a stated replacement of *Phloeodictyidae*, based on such generic synonymy. Carter's family name, moreover, is here judged to be invalid pending an appeal to the International Commission for its suppression, and *Oceanapiidae* can be said to be in general current use (ICZN Article 79c).

Oceanapia Norman

Oceanapia Norman, 1869: 334. — Ridley and Dendy, 1887: 32, 36 (in *Phloeodictyinae*). — Dendy, 1922: 45 (definition in *Phloeodictyinae*). — Topsent, 1928: 66 (in *Renierinae*). — Bergquist, 1965: 160 (discussion in *Adociidae*). — Lévi in Brien et al. 1973: 620 (definition in *Renieridae*). — Vacelet et al., 1976: 98f. (2 species described). — Van Soest, 1980: 85 (synonymy, definition), 91 (discussion), 114 (definition), 115 (illustration). — Bergquist and Warne, 1980: 37 (definition and discussion in *Oceanapiidae*).

Rhizochalina Schmidt, 1870: 35. — Ridley and Dendy, 1887: xiv, 32. — Bergquist, 1965: 160 (discussion). — Vacelet et al., 1976: 92–96 (7 species described). — Van Soest, 1980: 85, 92, 114 (synonymised with *Oceanapia*).

Phloeodictyon Carter, 1882a: 122. — Dendy, 1905: 165 (definition in *Phloeodictyinae*). — Dendy, 1922: 47 (definition in *Phloeodictyinae*). — Wilson, 1925: 419 (definition in *Phloeodictyinae*). — Bergquist, 1965: 160 (discussion). — Van Soest, 1980: 85, 91, 114 (synonymised with *Oceanapia*).

Biminia Wiedenmayer, 1977a: 124 (definition in *Nepheliospongiidae*). — Van Soest, 1980: 115 (definition in *Oceanapiidae*, probably synonym of *Oceanapia*). — Hoshino, 1981: 121 (in *Adociidae*, new species). — Hooper, 1984b: 55 (in *Oceanapiidae*, new species).

Diagnosis. "Oceanapiidae in which the ectosomal bark-like skeleton is reinforced by spongin, this trend being particularly evident in the fistule walls. Megascleres oxea; microscleres, when present, sigmata or [and] toxa." (Bergquist and Warne, 1980: 37.)

Oceanapia putridosa (Lamarck)

Plate 12 figure 8, text-figure 82

Alcyonium putridosum Lamarck, 1815 (1814–1815): 168 (King George Sound, WA, fide Topsent, 1933).

?*Rhizochalina putridosa*?. — Ridley and Dendy, 1887: 33, pl. 8 fig. 5, pl. 9 figs 1, 7 (Moncoeur Island, Bass

Strait, 70 m; off Sydney, 55–64 m; off Bahia?). — Whitelegge, 1906: 466 (off Sydney, 66–71 m).

?*Phloeodictyon putridosa* (sic). — Burton, 1928: 118 (16 mi. E of Devi River, Orissa Coast, India, 124 m).

?*Phloeodictyon putridosum*?. — Wilson, 1925: 419 (Philippines).

Phloeodictyon putridosum. — Topsent, 1933: 42, pl. 3 fig. 8 (description of holotype, discussion).

Material examined. Station BSS 187, one specimen (F52037).

Diagnosis. Cake-shaped, with low and stubby, irregular fistules bearing small, chiefly lateral oscules. Compressible, resilient, easily torn; deep brownish red in life. Surface smooth to finely wrinkled, with scattered sediment. Bark-like ectosome stratified, with 2–4 matted layers, each 1 mm thick, separated by floors of same height with scattered spicules and sparse spicular pillars. Choanosome fleshy, with ill-sorted detritus and macrosymbionts. Oxea variable, in 3 indistinct categories.

Description. Incomplete, torn off its base by dredge, subsequently damaged. Base probably originally cake-shaped. Preserved top, with jagged torn outline, 10 × 11 cm wide, 1.5 cm thick in middle, almost flat on one side, thrown into irregular, oblique adjoining turrets or fistules on other. One of these composite, bifid at top. Their height and width 2–3 cm. All three bear small, irregularly scattered oscules chiefly on one side, 1–2 mm wide, some clustered. One apex of composite middle turret bears larger oscule with contorted rim, diameter 4–5 mm. Other half of base bears two low elevations, 0.5 and 1 cm high and wide, with one small lateral oscule each. Marginal surface encrusted by platy calcareous alga, in turn overgrown by small unidentified sandy sponge, algae and hydrozoans.

Deep brownish red in life, now faded to deep fawn (7.5–10 YR 6–7/6–8). Compressible, resilient, easily torn.

Surface smooth, finely wrinkled over base, contains scattered sediment. Ostia visible at intermediate magnification, clustered over meshes of subjacent matted layer, between single tangential oxea. Underlying meshes about 100–300 µm wide,



Figure 82. *Oceanapia putridosa*, oxea, × 274.

often irregular in outline (composite, petaloid or lobed). Widths of tangential fibres in same order.

Below surface, 2 to 4 successive matted layers, mostly parallel, about 1 mm thick, separated by discontinuous floors with sparse single spicules and fibrous pillars, their height equal to thickness of matted layers. Some floors wedge out, with contiguous matted layers merging. Inner matted layers frequently riddled by round openings about 1 mm wide and 1–5 mm apart.

Remaining deeper choanosome indistinctly stratified, fleshy, contains ill-sorted detritus. Main skeleton typical for genus, with stringy terete fibres in all directions, indistinctly graded by sizes of fibres and meshes, occasionally with stronger more continuous fibres in planes parallel to surface, and interstitial oxea. Numerous commensal barnacles inside fistules.

Spiculation: oxea, mostly hastate, with conical points of variable length, occasionally submucronate, commonly curved or bent, 90–154–229 \times 2.5–5.9–13.8 μ m.

Remarks. The dry holotype, as described and partly figured by Topsent, is also badly preserved and fragmented. The spicules agree in shape and measurements including an indistinct segregation into three categories (holotype: intermediate ones, 140 \times 7–8 μ m, dominating; larger ones, up to 185 \times 12 μ m, fairly frequent; smaller ones, 130–140 \times 2–3 μ m, scarce). My identification is corroborated by the presence of a threefold bark layer with two intervening hollow layers in the holotype, and by the presence of sand at the surface. Topsent remarked on the differences of the "Challenger" specimens, a much more fibrous structure and uniform spicules measurements, but finally accepted the identification. Neither Ridley and Dendy nor Wilson (who indicated only 150–160 \times 8 μ m for the oxea of his specimen) mentioned a multiple bark layer. Pending a re-examination of these specimens, the question as to their identity with Lamarck's and the new specimen must remain open.

Order Dictyoceratida Minchin, 1900

Spongiidae Gray, 1867

Spongia Linné

Spongia Linné, 1759: 1348 (part).—Vacelet, 1959: 73 (definition, discussion, revision of Mediterranean species).—Wiedenmayer, 1977a: 54 (synonymy in part: not *Ceratodendron*, *Aphrodite* (= *Hippospongia*); additional references, definition, discussion, West Indian species).—Van Soest, 1978: 8, 19 (definition, revision of West Indian species).—Bergquist, 1980b: 450 (synonymy, definition).

[*Euspongia*] Bronn, 1859: 22 (nomen vanum, see Burton 1934a: 574).—Wiedenmayer, 1977a: 54 (further synonyms).

Ditela Schmidt, 1862: 24.

Diagnosis. "Spongiidae in which the primary fibres are reduced in number and the highly developed secondary network of fine, intertwined fibres makes up the bulk of the skeleton. Primary fibres contain a central axis of foreign material, and are most in evidence near the sponge surface. Secondary fibres contain no foreign material. The texture of the whole is springy and very compressible, supple and elastic. The surface is [rarely] armoured, is covered with low, even conules, and most frequently is pigmented black, brown, or grey; the interior is white to beige. The form of the sponge is variable, but commonly massive spherical, lamellate, or cup-shaped." (Bergquist, 1980b: 450.)

Spongia hispida Lamarck

Plate 12 figures 9–12, plate 34 figure 2

Spongia hispida Lamarck, 1814 (1813–1814): 452 ("Southern Seas", Péron and Lesueur collection).—de Laubenfels, 1948: 15, pl. 3 fig. 6 (= pl. 2 fig. 6 in Topsent, 1933).

?*Cacospongia mollior*.—Ridley, 1884a: 378 (nec Schmidt; see Lendenfeld, 1889b: 256; Torres Strait).

Euspongia irregularis Lendenfeld, 1885h: 485.—Lendenfeld, 1888: 132.—Lendenfeld, 1889b: 245 (collective name for following varieties, no nominotypical subspecies designated).—Brøndsted, 1926: 295 (New Zealand).

Euspongia irregularis var. *tenuis* Lendenfeld, 1885h: 485 (Torres Strait and Long Reef, Qld; Mauritius; Chatham Islands, NZ).—Lendenfeld, 1889b: 251, pl. 13 fig. 5 (old record).

Euspongia irregularis var. *jacksonia* Lendenfeld, 1885h: 485, pl. 36 fig. 3 (Sydney Harbour).—Lendenfeld, 1888: 133 (as *jacksoniana*, old record).—Lendenfeld, 1889b: 254, pl. 21 figs. 8, 9 pl. 22 fig. 17, pl. 29 fig. 1 (as *jacksoniana*, old record).

Euspongia irregularis var. *silicata* Lendenfeld, 1885h: 485 (St Vincent Gulf, SA; Sydney Harbour; Fiji; Chatham Islands, NZ).—Lendenfeld, 1888: 133, 134 (old records).—Lendenfeld, 1889b: 255 (old records).—Whitelegge, 1897: 331 (Funafuti).—Whitelegge, 1901: 95, 117, pl. 12 figs. 17, 17a (beaches of NSW).

Euspongia irregularis var. *lutea* Lendenfeld, 1885h: 485 (Mauritius).—Lendenfeld, 1889b: 250, pl. 12 fig. 9 (old record).

Euspongia irregularis var. *dura* Lendenfeld, 1889a: 31 (in key).—Lendenfeld, 1889b: 251, pl. 13 fig. 4 (East coast of Australia; Sri Lanka; Madagascar).

Euspongia irregularis var. *villosa* Lendenfeld, 1889a: 31 (in key).—Lendenfeld, 1889b: 252 (Australia; Chatham Islands, NZ; Madeira (?); Cape of Good Hope (?); Karachi).—Hentschel, 1912: 435 (Aru, Indonesia).

Euspongia irregularis var. *frondosa* Lendenfeld, 1889a:

31 (in key). — Lendenfeld, 1889b: 253, pl. 22 fig. 1 (Indian Ocean).

Euspongia irregularis var. *mollior* (nec Schmidt). — Lendenfeld, 1889b: 256 (in part: East Indies; Torres Strait, old record based on *Cacospongia mollior*: Ridley, 1884a). — Topsent, 1897: 484 (Ambon, Indonesia).

Euspongia irregularis var. *areolata* Whitelegge, 1901: 96, pl. 12 fig. 18 (Lake Illawarra, coast near Sydney, NSW).

Euspongia irregularis var. *suriganensis* Wilson, 1925: 486 (Surigao Strait, Philippines).

Euspongia irregularis var. *hispid*a. — Topsent, 1933: 1, pl. 2 fig. 6 (two syntypes of Lamarck described, lectotype designated and figured).

Spongia zimocca irregularis. — de Laubenfels, 1948: 14 (in review). — de Laubenfels, 1954a: 6, text-fig. 2 (Micronesia).

Spongia irregularis. — Desqueyroux-Faundez, 1981: 754, figs 95, 97, 130 (redescription of record in Topsent, 1897).

Material examined. Station KG 7, one specimen (F52038); station BSS 187, one specimen (F52039). Type specimens of *Euspongia irregularis* var. *tenuis*, *jacksonia*, *silicata*, *lutea*, *villosa*, *frondosa* Lendenfeld (AM and BMNH), and of *E. irregularis* var. *areolata* Whitelegge (AM).

Diagnosis. Shape variable, massive-lobate, lamellate, erect or repent-ramose, often irregularly anastomosing. Spongy; externally black to dark grey, often reddish in life. Surface conspicuously and regularly conulose, hispid after collecting. Dermal membrane thin, partly deciduous after collecting, frequently contains some foreign inclusions (spicular debris). Choanosome dense. Main skeleton irregular, with straggling primaries always containing detritus, with pale spongin; secondaries of variable thickness, clear. Some detritus also interstitial.

Description. F52038 (pl. 12 fig. 9) larger, irregular, capricious. Gross shape like upper quarter of ovoid body. Base deeply excavated. Outer, convex side thrown into parallel to radial, erect ridges, 5–10 mm wide, separated by grooves of similar width. Some ridges branch downward, most obliquely and irregularly dissected by anastomoses between neighbouring vertical grooves, hence a succession of irregular hummocks and pinnacles. Single large oscule, 12 mm wide, with raised collar, cuts across 2–3 ridges near top. Inner, truncate side with fainter relief, irregularly cutting across several erect lamellae. Base excavated by 3 to 4 arches, as if sponge had grown over as many cobbles. From arches, several lacunae, 0.5–1.5 cm wide, reach deep inside, toward top. Grooves on outer side variable in depth, few millimetres to over 1 cm. Some still covered by dermal membrane, now much receded, partly collapsed, partly still stretched above bot-

toms. Relief less pronounced in life (colour slide after collecting). Membranes pierced by small oscules, some in series, 1–5 mm wide.

Almost black to dark grey, with reddish tinge in life (10 R 3–4/1), now faded (10 R 4–5/2), only partly preserved, dermis having disappeared near base and along edges of some ridges. Bottom, now as in life, yellowish beige (10 YR 8/4). Choanosome lighter, almost cream. Spongy, moderately firm.

Surface on prominent parts of outer side finely conulose to hispid. Conules mostly composite, about 1 mm high and apart, bifid to trifid, with barely protruding primary fibres; connected by ridges. Hispidation less prominent on inner side. Ostia not seen. F52039 (pl. 12 fig. 10) much smaller, digitate-ramose. Two short, parallel branches, 2.5 cm long and 8–10 mm thick, out of base of main branch about 9 cm long, 1.5 cm thick proximally, 1 cm distally. Latter much constricted, almost severed 3 cm above base.

All branches have grooves down from apex along one side for about 1 cm, with smooth walls and few small oscules partly closed. Similar grooves less conspicuous further down sides.

Surface dull greyish red in life (now more brown, 10 R 4–5/2–4); choanosome paler. Alcohol stained orange-brown. Conules less prominent than in F52038, with primaries occasionally protruding. Dermal membrane better developed, showing reticulum of collagen nervures with main lines converging in conule tips, parallel with subjacent uppermost secondaries.

Choanosome dense, opaque, more so in F52039, riddled by anastomosing canals about 100–300 μ m wide. Matrix contains abundant globular microsymbionts, of different kinds in two specimens. Main skeleton in both with straight to slightly straggling primaries, 28–47 μ m thick, rarely branched, spaced irregularly 200 μ m to about 2 mm, filled with foreign detritus, chiefly spicule fragments, many almost complete, generally well aligned with tips protruding here and there, hence knotty contour of some fibres. Sand grains or other debris rare. Encasing pale yellow spongin barely visible. Debris (spicules, lithic fragments, foraminifera) also interstitially, loosely scattered or clustered. Secondary fibres and their meshwork irregular, with little if any relation between thicknesses (4–32 μ m) and meshsizes (20–390 μ m), except thicker fibres occasionally forming ill defined fascicles with more uniform meshes. Secondaries straight to slightly bent between junctions, pale, yellow, always clear, enclosing triangular to polygonal meshes. Dermis in both specimens armoured by spicule fragments.

Remarks. The species is externally highly polymorphic, as the synonymy shows in accordance with Lendenfeld's taxonomic concepts. F52038 does not fit any of the described varieties well, but can be interpreted as a more complex growth form of var. *areolata*, in which secondary, lateral erect lamellae are attached at right angles to mesial lamella bearing large oscules along its rim. F52039 can be conceived as a young stage of the more complex var. *jacksonia* (stubby, digitate branches, see pl. 12, fig. 11) or of the typical variety (Lamarck's specimens: longer, tangled branches).

As in *Carteriospongia* (see below), the composition of the detritus filling the primaries has no systematic importance. The almost exclusive content of foreign spicules (used by Lendenfeld to separate var. *silicata*), of grains only, and of mixed types seem to occur indiscriminately.

The armoured dermis, not previously recorded in this species, necessitates the slight modification of the generic diagnosis (above) with respect to Bergquist's (1980b: 450).

The affinity with *Cacospongia mollior*, claimed by Lendenfeld (1889b), can be excluded, given the differences in skeletal structure (Bergquist, 1980b: 460; Pulitzer-Finali and Pronzato, 1977: 92, fig. 3). The affinity with *Spongia zimocca*, claimed by de Laubenfels, is doubtful. The latter species is primarily East-Mediterranean, and Australian and East Indian records should be re-examined. The true nature of the skeletal structure of topotypes of *S. zimocca* is still not firmly established (see Vacelet, 1959: 78).

***Carteriospongia* Hyatt**

Carteriospongia Hyatt, 1877: 540 (definition and discussion in *Phyllospongiadae*, 5 species included, another one questionably). — de Laubenfels, 1936a: 21 (definition in *Spongiidae*). — Bergquist, 1965: 132 (discussion, implicitly merged in *Phyllospongia*). — Bergquist, 1980b: 454 (synonymy, definition in *Spongiidae*, discussion, revision).

[*Carterispongia*] Ridley, 1884a,b: 385 (nomen vanum; synonymy, discussion, valid subsequent designation of *Carteriospongia otahitica* sensu Hyatt (non *Spongia otahitica* Esper) as type species, subject to decision by International Commission, description of Australian records), 594 (description of Indian Ocean records). — Burton, 1934a: 572 (invalid subsequent designation of *Spongia foliascens* as type species). — de Laubenfels, 1948: 126 (discussion as nomen vanum).

[*Carterospongia*] de Laubenfels, 1948: 126 (nomen nullum; merged in *Phyllospongia*).

Polyfibrospongia Bowerbank, 1877: 459. — Bergquist, 1980b: 454 (merged in *Carteriospongia*).

Mauricea Carter, 1877: 174. — Ridley, 1884a, b: 385, 594 (merged in *Carteriospongia*). — Bergquist, 1980b: 454 (syn-

onymy accepted), 456 (type species misidentified as *C. foliascens*).

?*Lendenfeldia* Bergquist, 1980b: 456.

Diagnosis. "Spongiidae in which the primary fibres are cored with detritus and do not run in regular fashion from surface to surface of the compressed body. The fibres wander at all angles to the surfaces, branch, and frequently are in weak fascicles. The secondary network is very highly developed, made up in the main of very thin, tangled fibres branching and anastomosing, occasionally fasciculate. Fine tertiary fibres are apparent in some species. Secondary fibres are clear of detritus. The surfaces of the sponge are [commonly?] reinforced by a sandy cortex which is often quite thick; the surface itself is usually marked by fine ridges and grooves. The texture is compressible, and the shape of the sponge is variable, but the body is always thin, compressed lamellate or cylindrical." (Bergquist, 1980b: 454.)

Remarks. There is still some confusion about the taxonomy of this genus, particularly about its type species, the synonymies and correct names of the species assigned to it, and to whether it is really distinct from *Phyllospongia*. Burton (1934a: 572) designated *Spongia foliascens* Pallas as type species of *Carteriospongia*, stating that this is a senior synonym of the first species described in *Carteriospongia* by Hyatt (1877), *Spongia otahitica* Esper (as *Carteriospongia otahitica* Hyatt). ICZN Article 69a (v) would apply here if Burton's designation were valid. He overlooked the fact, however, that already Ridley (1884a: 385) had effectively designated as type species the first species described by Hyatt in his new genus, but in another sense than Burton. Ridley (loc. cit.) stated: "Hyatt formed the genus *Carteriospongia* nominally for a species called by him *otahitica*, Esper, which is, however, apparently *lamellosa*, Esper, to the plate of which he refers". This statement is sufficient to constitute a subsequent designation (ICZN Article 69a (iv)), and as such has priority over Burton's. It is also clear, however, that Ridley regarded Hyatt's first described species as misidentified, a fact corroborated by Hyatt's explicit description, which leaves no doubt that he had before him *Carteriospongia lamellosa* (Esper) (the junior synonyms of which are *Spongia polyphylla* Lamarck, *Spongia laciniata* Lamarck, *Carteriospongia radiata* Hyatt, *Mauricea lacinulosa* Carter, and *Carteriospongia pennatula* sensu Ridley et auct.).

The type species of *Carteriospongia* cannot be cited as *Spongia otahitica* Esper (ICZN Article 49), nor can it presently be cited as *Spongia lamellosa* Esper (ICZN Article 70b). Pending a decision by

the International Commission in this matter, the type species of *Carteriospongia* has for now to be regarded as void. An eventual acceptance of *Spongia lamellosa* as type species would not affect the scope of *Carteriospongia*, since this species (as *penatula*) is also included in this genus by Bergquist (1980b). *Phyllospongia* and *Carteriospongia* were apparently kept distinct, though diagnosed together, by Lévi (in Brien et al., 1973: 625), but later merged (Vacelet et al., 1976: 106). As diagnosed by Bergquist (1980b: 454), the two genera seem sufficiently distinct, but it remains to be demonstrated whether newer specimens of the species complex *Phyllospongia papyracea* (with *holdsworthi*, *madagascarensis*, *distans*, *coriacea*) always hold up to Bergquist's diagnosis. Until such time, *Carteriospongia* is here retained. For possible synonymy of *Lendenfeldia*, see below, remarks on *C. silicata*.

***Carteriospongia caliciformis* Carter**

Plate 13 figures 1–7, plate 34 figure 3,
text-figures 83, 84

Carteriospongia caliciformis Carter, 1885b: 221 (Port Phillip Bay, Vic.). — Bergquist, 1980b: 454 (good species).

Phyllospongia (Antheroplax) caliciformis. — Lendenfeld, 1889b: 182, pl. 5 fig. 1 (Westernport Bay, Vic.; Sydney Harbour).

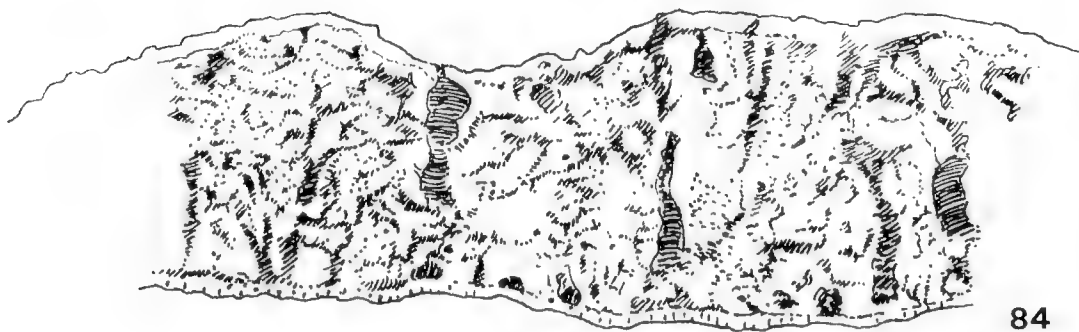
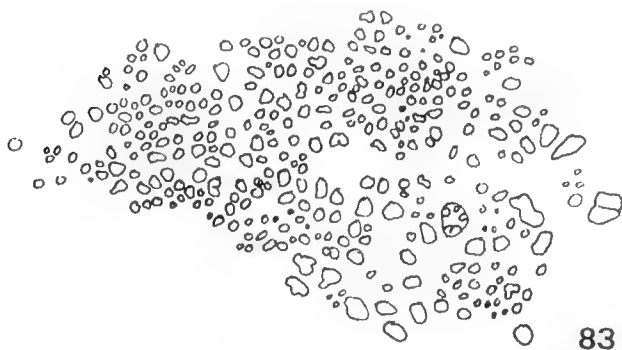
Phyllospongia calyciformis. — Bergquist and Skinner, 1982, pl. 4 fig. 1 (colour, southern Australia).

Phyllospongia aliena Wilson, 1925: 481, pl. 51 fig. 10 pl. 52 figs 1, 3, 5 (Philippines).

?*Cacospongia poculum* Selenka, 1867: 567, pl. 35 fig. 7 (Port Phillip Bay).

Material examined. Station KG 3, two specimens (F52040a,b). Syntypes of *Carteriospongia caliciformis* Carter (BMNH).

Diagnosis. Wide-mouthed conical cups with single or multiple stalk. Smaller specimens smooth or weakly sculptured on both sides, larger specimens with regular sculpture, coarsely rugo-reticulate on outside, more meandrine or vermiculate in concavity. Secondary cups frequent in concavity of larger specimens. Oscules small, regularly scattered in concavity, inconspicuous in large specimens. Firmly rubbery, more resilient along rim; purplish or pinkish brown, with lighter patches in life. Surfaces micropapillate. Ostia on inhalant outer side scattered to crowded, tending to segregation by 2 sizes. Armoured ectosome 150–500 μm thick, underlain by crypts on outside. Choanosome caver-



Figures 83, 84. *Carteriospongia caliciformis*. F52040a, details in reflected light. Figure 83. View of inhalant surface, $\times 11.7$. Figure 84. Perpendicular section, $\times 6.3$. Exhalant surface above.

nous, canals often of 2 sizes. Interstitial detritus. Main skeleton typical for genus, dense, with closely spaced, distinct primaries.

Description. Wide-mouthed calices. F52040a larger, cup somewhat compressed, asymmetrical, sinuous margin descending to about half height of opposite wall on one broadside. Opposite radii of inner wall, from bottom to rim, 10.5 and 8.5 cm along longer axis of ellipse, converging at 120° ; those along shorter axis are 9 and 6–7 cm, converging at 110° (inclination steeper along lower wall). Width at mouth 12×17 cm. Asymmetrical pedicel below conical bottom inclined 30° away from axis of cup, slightly bent, expanded below into sprawling holdfast with perpendicular base. Pedicel 3 cm long in middle, 1–1.4 cm thick; elongate base of holdfast 3×6 cm wide. Cup wall 6–7 mm thick near bottom, 2–3 mm at sharp rim. F52040b a similarly shallow, compressed cup with asymmetrical rim. Inner radii 3.5 to 7.5 cm, width across rim 8.5×11 cm. Five thin pedicels from horseshoe-shaped ridge surrounding concavity, 2 cm wide, at bottom of cup. Pedicels inclined outwards radially, contorted, wedging out into little expanded holdfasts; proximally 5–10 mm wide, 2–4 cm long including holdfasts.

Purplish to pinkish brown in life, lighter in some areas, now mottled beige, with greyish, brownish, yellowish and orange tinges. Firmly rubbery across rim, little compressible across cup wall, less across pedicels.

Outer surface of both cups and of pedicels smooth in general, but minutely granular. Stronger, coarser granulation on inner surface. On both sides of rim, granules mostly aligned radially, to 1–3 cm below rim on inside, up to 5 cm deep on outside. Individual granules of inner, exhalant surface frequently confluent, in short meandering and branching ridges, 350 to 500 μm wide, interstitial grooves slightly narrower.

In F52040a, small oscules regularly scattered over inner surface, but almost lacking in bottom (width 4–5 cm), spaced about 3 mm, single or composite (clustered), 200 μm to 1 mm wide, now partly closed, in shallow depressions of vaguely rugoreticulate pattern. Oscules often at centre of radially confluent subdermal canals about 200 μm wide. In bottom, similar canals arranged in dendritic to loosely reticulate pattern, often pierced by crowded oscules about 100 μm wide. Similar pattern, but more radial, below rim, coinciding with interstices of aligned granules.

In F52040b, oscules more irregularly and widely spaced on inner surface, mostly at 5 mm, but scarce in some areas. Coarser, more prominent rugo-

reticulation on parts of surface, with oscules in pits. Meandering and dendritic subdermal canals with crowded smaller oscules particularly in smoother areas with fewer single oscules. Large portions of outer surface, particularly in F52040a, with distinct, irregular reticulum of subdermal canals about 200 μm wide, meshes 1–3 mm wide, riddled by larger ostia, 135–330 μm wide, irregularly scattered. Interstices pierced by crowded smaller ostia, around 65 μm wide. Where reticulum indistinct, little segregation of ostia by size, spacing and areas (text-fig. 83). Armoured ectosome of F52040b 125–375 μm thick on inner surface, mostly 150 μm thick on outer surface, below which a zone of extensive crypts. Choanosome riddled by complex canal system, with two size ranges, intergrading occasionally: (1) canals 250–750 μm wide, predominantly transverse; (2) 65–125 μm wide, reticulate, commonly oblique (text-fig. 84). Main skeleton of F52040b comprises closely spaced primaries (350–750 μm apart), knotty, 100–135 μm thick, occasionally with lacunae, charged with foreign debris (mostly spicule fragments, poorly aligned, sometimes discontinuous). Irregularly scattered detritus also interstitially. Secondaries 18–65 μm thick, tangled and crowded, mostly oblique in all directions, with indistinct meshes. Here and there, particularly between closely spaced primaries, ascending and transverse secondaries evident, with meshsizes around 100–200 μm . All secondaries with darker axial filament; thicker, more continuous ones (more deeply stained by basic fuchsin) distinctly stratified in periphery. Thinner, shorter ones have trumpet-shaped junctions cut off by continuous wall of perpendicularly joined thicker fibre, as if grafted. Base of such junctions frequently drawn out to join base of neighbouring transverse secondary, forming additional layer on wall of joined thicker fibre.

Inhalant ectosome in F52040b comprises outer zone, 100–160 μm thick, with packed spicule fragments, pierced by ostia, and inner zone, 230–350 μm thick, with scattered to crowded spicule fragments, traversed by primaries, generally free of secondaries, containing crypts.

Main skeleton below exhalant surface irregular, tangled, with primaries indistinct, fasciculate, oblique and branching, ending in elevations (granules) of surface; spaces below intervening depressions almost devoid of secondaries and contain small atria. More interstitial detritus than below opposite surface, with many lithic grains.

Remarks. Expanding junctions of secondaries enveloping primaries agree with what Wilson (1925) described and figured for *Phyllospongia aliena*. The

cementation of a crossing secondary of similar thickness by a peripheral layer of the crossed fibre (Wilson, 1925, pl. 52 fig. 3) was also observed, as were some knobby ends of free fibres, however overgrown by a new outer layer extending into a fibre of thinner diameter continuing in the same direction beyond the knob of the first stage. *Carteriospongia foliascens* may be quite similar to the present species in shape, though its cup-shaped wall is often spirally coiled. The main distinction there, however, is the presence, on the inner surface, of a regular and prominent primary pattern of crowded papillae or radially oriented vermiculate ridges with narrow interstices. This pattern (see Bergquist, 1965: 131; Lévi in Brien et al. 1973, fig. 428) is much coarser and more prominent than the granulation of *C. caliciformis*, which is also mentioned by Wilson (1925) for *C. aliena*. Superimposed on the rugo-vermiculate pattern of *C. foliascens*, especially in larger specimens, is often a more irregular secondary one of mamelons and lobules (see Bergquist, 1965, fig. 3a; Vacelet, Vasseur and Lévi, 1976, pl. 5 fig. f). An analogous, but different secondary surface relief occurs in *C. caliciformis*: it is the coarse rugo-reticulate pattern already noticed on the inside of the smaller new specimen. It is much more pronounced in the larger of the two syntypes of Carter here figured for comparison (pl. 13 figs. 6-7), where it also characterises the outer surface. Both syntypes of Carter, furthermore, show the tendency, in this species, for the excrescence of an additional frond or cup from the bottom.

The occurrence of *C. foliascens* in southern Australia is doubtful and needs to be verified. The species is common in shallow reef environments in the whole Indo-West Pacific Region. Records from Victoria, New Zealand and New South Wales are based on synonymies and records in Lendenfeld (1888: 177; 1889b: 196), whose identifications, particularly with many supposedly conspecific specimens, are always suspect, in my experience with his type series in Sydney and London.

Carteriospongia silicata (Lendenfeld)

Plate 13 figures 8-12, plate 14 figures 1-5

Phyllospongia (*Carteriospongia*) *silicata* Lendenfeld, 1889a: 26 (in key). — Lendenfeld, 1889b: 195, pl. 7 fig. 8 (Torres Strait). — Bergquist, 1980b: 456 (in review, as unrecognisable).

Carteriospongia elegans. — Burton, 1934a: 600 (nec *Phyllospongia elegans* Lendenfeld; Great Barrier Reef).

Material examined. Station WB, one specimen (F52048). Holotype of *Phyllospongia silicata* (BMNH). Three hypotypes of *Carteriospongia elegans*: Burton, 1934a (BMNH

1893.3.4.24, Great Barrier Reef; BMNH 1893.3.4.63, -69, Bass Strait, latter locality unpublished).

Diagnosis. Asymmetrically saucer-shaped, rim often elliptical, with short stalk. Surfaces smooth or sculptured, pattern of latter strongly and coarsely rugo-reticulate, rugo-vermiculate or tuberculate, except for rims, which have a weaker, radial, scalloped sculpture. Surface otherwise micropapillate, lipostomous in life; papillae radially aligned around rims. Rubbery; dark red to red-brown on exposed parts, pale vermilion in depressions, in life. Armoured ectosome not over 150 μm thick, often patchy, evanescent or lacking. Dry specimens hence often with irregular whitish patches, surface otherwise radially striate (alignment of primary fibres in periphery). Deeper main skeleton more irregular, primary fibres indistinct, lumpy.

Description. Like a very shallow goblet (pl. 13 figs 8-10), elaborately and symmetrically decorated. Rim slightly upturned from base, oval outline 6 \times 7.5 cm in width. Peripheral width of 1-1.5 cm decorated above by radially arranged, straggling and sparingly branched ridges and grooves. Ridges around 1 mm wide, grooves 1-2 mm. Similar pattern, but much weaker, on underside of rim. Flat bottom of cup (33 \times 52 mm) with much stronger pattern of partly anastomosing lobules and ridges, 1 to 4 mm wide, up to 5 mm high. Similar, more rugo-reticulate pattern on base. Compressed, short pedicel vertically from base, somewhat off-centre, 12 mm high, 6 \times 9 mm thick in middle, expanding below into two sprawling rhizomes at right angles, both about 2 cm long. Total height above pedicel 2.5 cm. Thickness of rim 4 mm proximally, 3 mm distally. Thickness near centre, including erect lobules, 1 cm. Upper face in life dark red-brown (10 YR 3-4/2-4) on elevations, pale vermilion (10 YR 7/8) in depressions. Underside was deep dark red (5 R 6/3) to dull vermilion (10 R 8/6), now faded superficially to uniform beige (10 YR 7-8/3-4). Choanosome in centre brownish orange (5 YR 6-7/8). Rubbery.

Surface in depressions with fine granulation, barely visible on underside, more distinct on upper face. Granules on both sides aligned radially along outer half of rim. Granules on upper side 500-600 μm wide, occasionally confluent, with narrow interstices. Numerous oscules, 100-600 μm wide, irregularly scattered, mostly round, occasionally elongate. Underside completely riddled by very regular fine ostia, barely visible at low magnification, with narrower interstices.

Armoured ectosome 100-135 μm thick, with packed to crowded mixed detritus in variable

proportions: spicule fragments dominate in some areas, lithic and skeletal grains in others. Ostia around 85 μm wide, interstices around 45 μm . Peripheral zone in main skeleton with primaries more or less erect, 75–120 μm thick, spaced 400–1000 μm , knotty, lacunose, often discontinuous below, passing into usually fasciculate secondaries. Periphery also comprises lax secondary reticulation of clear, pale fibres, crypts, and interstitially scattered spicule fragments.

Deeper main skeleton highly irregular, primaries thicker (up to 250 μm), very lumpy, with single very large lithic grains (mostly quartz) almost exclusively, completely enveloped in spongin. Primaries may form irregular meshwork, with meshes 320–560 μm wide. Many "primaries" merely lumps of 1–3 grains enveloped in spongin and joined on 2–4 sides by secondaries. Secondaries 25–60 μm wide, mostly straight, either crowded or vaguely fasciculate, particularly below periphery, or forming lax angular meshwork, with meshes up to 420 μm wide.

All fibres of deeper choanosome rusty in transmitted light, in shagreen-like pattern, like leopard-skin with high magnification, corresponding to brownish orange central zone noted above. Its boundary not always that with peripheral skeleton, may reach deep inside, or almost to ectosome. Microscopic pattern occasionally on two successive fibre layers, frequently overgrown by clear spongin.

Some thinner fibres form short anastomoses between adjoining, mostly parallel secondaries, generally 12–18 μm wide, possibly tertiary fibres, but intergrading with secondaries in diameter. Their "grafted" junctions trumpet-shaped (as noted in *C. caliciformis*), usually accentuated by rusty layer.

Remarks. I have formerly assigned this species to *Lendenfeldia* (Wiedenmayer et al., in press), relying on macroscopic characters only. In examining dry material of the type species of *Lendenfeldia* in London (BMNH), i.e. *L. plicata* (Esper) (with synonyms *lamellaris*, *torresia*, *dendyi* with varieties, *ridleyi* with varieties, *polyphemus* and *arenifibrosa*), I noticed the common radial alignment of primaries and their tips (conules) near the rim on both sides of the fronds, often affecting the whole outer half of the frond surface. This was also noticed on the dry holotype of *Phyllospongia silicata* and in Burton's dry specimens mentioned above, where it obviously corresponds to the radially aligned granulation in the new specimen. A similar pattern, though less pronounced, was noted above for *Carteriospongia caliciformis*.

No trace of an armoured ectosome was noticed in the dry specimens of *L. plicata*. However, in the

wet syntypes of *Megalopastas arenifibrosa* Dendy and Frederick (which I did not examine) the ectosome "sometimes contains a good many broken spicules", according to the original description. Of Burton's (1934a) three specimens of "*Carteriospongia elegans*" (Saville Kent coll., two of which are identified on the label (by Burton?) as *Phyllospongia silicata*) only the one from the Great Barrier Reef (the other two are from Bass Strait) has extensive patches of whitish ectosome still preserved on the lower side. In the other two, and in the holotype of *Phyllospongia silicata*, the armoured ectosome is reduced to traces.

The salient diagnostic characters in Bergquist's (1980b: 456) definition of *Lendenfeldia* are: (1) absence of a sand cortex, (2) absence of grooves on the surface, and (3) presence of a tertiary fibre net. All three seem to be of doubtful value, probably constituting differences of degree only.

A common growth form in *Carteriospongia silicata* is that of wide, shallow cups with a short pedicel, with the concavity (and to a lesser degree the outside) usually decorated by more or less regular protuberances. The concavity of large specimens also contains irregular frond-like excrescences in the bottom. According to J.N.A. Hooper (personal communication), numerous specimens of this species in the Great Barrier Reef are without obvious pedicel, and lie flat on the substrate, or raised only slightly above it.

Carteriospongia cf. *vermicularis* Lendenfeld

Plate 14 figure 6, plate 34 figure 4

?*Phyllospongia* (*Carteriospongia*) *vermicularis* Lendenfeld, 1889a: 26 (in key). — Lendenfeld, 1889b: 201, pl. 15 fig. 5 (west coast of Australia).

?*Carteriospongia vermicularis*. — Burton, 1934a: 573 (Eagle Island, Great Barrier Reef).

?*Phyllospongia vermicularis*. — Brøndsted, 1934: 26 (Bandanaira, Indonesia).

Material examined. Station BSS 180, one specimen (F52041).

Description. Single straggling branch, 4.5 cm long (without base, now dissected), variably terete to slightly compressed, proximally 6 to 3 mm wide, tip subclavate, 15 mm long, 7 mm wide. Partially incorporated lacy bryozoans and fragments of clam shells, including an almost complete *Pecten* valve.

Yellowish beige in life (2.5 Y 8/2–4), now slightly darker (10 YR 7/4). Spongy, resilient. Surface finely conulose to hispid, with conules around 300 μm high and 1 mm apart. Tips of primaries protrude here and there, especially around apex, for up to 300 μm . Surface contains conspicuous, scat-

tered detrital grains and foraminifera. Surface in upper half riddled by round orifices about 100–200 μm wide, around 200–300 μm apart, now mostly closed, presumably oscules. Special, presumably inhalant field on lower half of one side of subclavate tip, free of conules, with polygonal orifices of similar width in regular meshes of reticulum formed by armoured ectosome. Few lacunae in surface, about 0.5 mm wide, one forming longitudinal vermiculate groove 15 mm long, with smooth fleshy wall. Spots devoid of armoured ectosome, flesh below shrunk, peripheral main skeleton visible.

Transverse sections near base show scarce straggling primaries more or less radial from axial region to surface, 55–80 μm thick, knotty, occasionally branched, often fasciculate, half filled with spicule fragments and lithic grains in disorderly fashion, often off-axis and protruding. Secondaries of pale beige spongin 10–55 μm thick, straight to bent or curved, in lax meshwork with meshes 100–400 μm wide. Outer spongin layer occasionally visible on thicker secondaries; “grafted” junctions of thinner ones not as distinct and frequent as in *C. caliciformis*. Periphery contains lacunae in main skeleton, 500–600 μm deep, traversed by primaries only. Ectosome packed with ill sorted mixed detritus (spicule fragments, skeletal and lithic grains up to 700 μm wide), about 200–300 μm thick.

Remarks. Lendenfeld's (1889b) description does not fit the present specimen well. His figure (pl. 15 fig. 5) is reduced to two-thirds natural size, if the total dimensions 12 \times 12 cm given in the description are accepted. The bundle of numerous straggling branches, around 2 mm thick (thus thinner than in F52041) is not incompatible with this being a larger, more prolific specimen of the same species as F52041. The round holes and longitudinal grooves in the surface also agree. The surface is said to be smooth, and to be characterised by a special sandy reticulum. It is possible that what is described above as a single inhalant field is more extensive in the larger holotype, and that Lendenfeld overlooked the conulose exhalant areas, which might not be as conspicuous in a dry specimen. The holotype could not be found, neither by Burton (1934a: 574), nor by myself, during my survey of the dry type collection in London (BMNH, 1983), which is now rearranged systematically. There are, however, still some boxes of unsorted exotic specimens from the old collection of Gray's and Bowerbank's time, which might contain the holotype. Burton's specimen has branches up to 10 mm thick. Brøndsted's specimen, identified with a question mark and only briefly described, is said to form “a richly branched bushy structure with cylindri-

cal to somewhat flattened branches.” According to J.N.A. Hooper (personal communication), more than one thinly ramose *Carteriospongia* with Indo-Malayan and Australian distribution occur, hence I prefer an open name pending availability of the lost holotype or of similar topotypes.

Coscinoderma Carter

Coscinoderma Carter, 1883c: 309. – Bergquist, 1980b: 456 (definition, discussion, revision).

Diagnosis. “Spongiidae in which the primary fibres are cored and the secondary elements are clear, extremely fine, numerous, and intertwined. Carter's analogy with ‘whorls of wool’ was very apt. The surface of the sponge is invested with a sand armour, but the texture remains soft, spongy, and extremely compressible. The sponge body is flabellate, pyriform, massive, or pedunculate, with apical or marginal oscules.” (Bergquist, 1980b: 456.)

Coscinoderma pesleonis (Lamarek)

Plate 14 figures 7, 9, text-figures 85–88

Spongia pes leonis Lamarek, 1814 (1813–1814): 379 (Southern Seas, Péron and Lesueur collection).

Coscinoderma pes leonis. – Topsent, 1930a: 33, text-fig. 3, pl. 1 fig. 6 (description of holotype, discussion; Australia confirmed).

Spongelia incerta Hyatt, 1877: 533, pl. 16 fig. 32 (Phillip Island, Vic.). – Bergquist, 1980b: 456 (as synonym of *Coscinoderma pesleonis*).

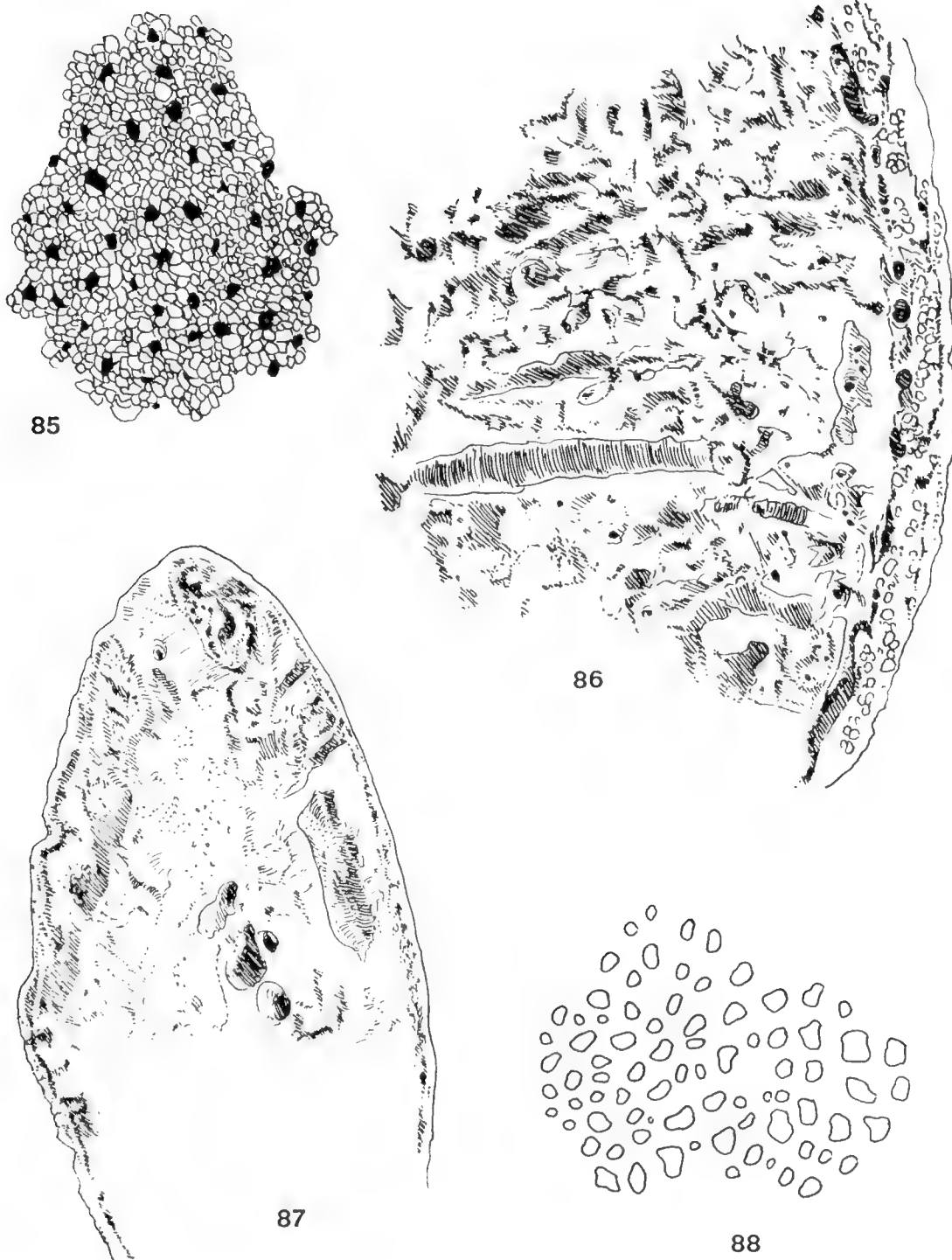
Coscinoderma lanuginosum Carter, 1883c: 309 (Freemantle, WA). – Carter, 1885c: 318 (Port Phillip Heads, Vic.). – Lendenfeld, 1889b: 332, pl. 12 fig. 11 pl. 20 fig. 11 (old records). – Bergquist, 1980b: 456 (as synonym of *C. pesleonis*), figs. 6c (holotype), 6f (secondary skeleton).

Coscinoderma pyriformis Lendenfeld, 1889a: 38 (in key).

Coscinoderma pyriforme Lendenfeld, 1889b: 334 (part, as unjustified replacement of *Spongelia incerta* Hyatt; nec *Spongelia spinosa* Hyatt, also cited in synonymy; Tas.). nec *Coscinoderma pyriforme* (varr. a and b). – Dendy and Frederick, 1924: 512, 513 (= *Spongia* sp. fide Bergquist, 1980b: 458).

Material examined. Station KG 4, two specimens (F52042, F52043); station KG 6, one specimen (F52044); station BSS 187, one specimen (F52045). Hypotypes of *Coscinoderma lanuginosum*: Carter, 1885c (BMNH).

Diagnosis. Stalked or compressed-pedunculate, distally globular, pyriform, or thickly flabellate. Oscules commonly elevated, forming apical (and lateral) crest, but also irregularly scattered on sides. Surface conspicuously sandy in life, with skeletal ostia barely visible, may be traversed by meandering grooves in flabellate specimens. Otherwise like in generic diagnosis.



Figures 85–88. *Coscinoderma pesleonis*. Details in reflected light. Figure 85. F52042, view of coarsely sandy surface, $\times 6.8$. Figure 86. F52042, perpendicular section (surface on right margin), $\times 6.8$. Figure 87. F52043, perpendicular section, $\times 4.1$. Figure 88. F52043, view of surface (ostia only), $\times 6.8$.

Description. F52042 fairly symmetrical, with almost globular, slightly compressed top, 5×6 cm wide, 6 cm high; inclined pedicel, proximally compressed and transversely corrugated, 5.5 cm tall, 7–15 mm wide, slightly expanded at base. Apical crest, 5.5 cm long, formed by series of con crescent elevated oscules. Few raised oscules irregularly scattered on either side, another two, little prominent, below each end of crest.

F52043 more elaborate, with larger, more compressed top, 4×7 cm wide, 8 cm high, deep oblique concavity on one side. Apical crest with oscules less distinct, extended downward on side with concavity, curved, branching. Strongly compressed pedicel 4 cm long, 4×10 mm wide, ends in rhizomatous base.

F52044 has top elongated crosswise, higher and slightly thicker at one extremity; 72 mm across, 27 to 35 mm high, 24 to 28 mm thick. Without crest, oscules small and flush, top thrown into irregular ridges outlining shallow contorted depressions. Compressed pedicel short (1 cm), not expanded at either end, torn off its base.

F52045 smallest; terete, transversely corrugated pedicel 23 mm high, 4 mm wide; slightly compressed narrow main part gradually expanding to maximum width 23 mm, 4 cm above pedicel, then slightly constricted below two unequal distal oscules. Total height 9 cm.

In life and in alcohol light grey to beige with faint pink or orange tinge. Compressible and resilient, surface firm and slightly rough.

Weakly magnified surface variable between specimens, in average size of sand grains, width and spacing of ostia (text-figs 85, 88). Ostia 100–350 μ m wide, 0.5–1.3 mm apart in F52042, 150–600 μ m wide and equally spaced in F52043.

Armoured ectosome 700–800 μ m thick, subjacent zone of crypts 200–400 μ m thick (text-figs 86, 87). Choanosome traversed by conspicuous, closely spaced radial canals 0.3 to 1 mm wide, anastomosed at right angles, communicating with canals 100–200 μ m wide. Few deeper canals, 2–2.5 mm wide, mostly parallel with surface, probably extensions of the atria, similar in width. Walls rugoreticulate.

Primary fibres straggling, regularly spaced 850–1000 μ m, 55–80 μ m thick, knotty, with spicule fragments and scarce other debris disorderly enclosed, many protruding, rarely filling whole fibre. Secondaries clear, pale, very long, tangled, isodiametric around 32 μ m, with faint axial filament; connection by scarce short anastomoses, 15 μ m thick, barely expanded and “grafted” at junctions, occasionally torn off (cf. Topsent, 1930a: 34, text-fig. 3).

Remarks. This is so far the only species of *Coscinoderma* recorded from Australia. The West-Indian *Coscinoderma lanuga* de Laubenfels (1936a) was admitted as second species by Bergquist (1980b: 458), but is still poorly known. Van Soest (1984: 30), who examined a schizotype, merely stated that it has a thick coat of sand and a skeleton “much more slender” than *Coscinoderma? musicalis* (Duchassaing and Michelotti), also West-Indian. From van Soest’s description and text-figure of the skeleton of the latter, I conclude that it is not congeneric with *C. pesleonis*.

C. pesleonis is often externally similar to *Thorecta latus* (Carter; see Remarks on *Thorecta choanoides*, below). The peduncle of the latter is often less individualised, shorter, its oscules are flush or slightly elevated, and, if apical, not aligned in a crest as in *C. pesleonis*. The skeletal ostia are more widely spaced in *C. pesleonis*, punctiform, whereas they are commonly polygonal or compound, in the meshes of a finely rugo-reticulate or clathrate armour in *T. latus*. The chief difference is in the skeletal structure, which makes *C. pesleonis* softer, more compressible.

Leiosella Lendenfeld

Leiosella Lendenfeld, 1888: 120. — Lendenfeld, 1889b: 201 (part). — de Laubenfels, 1936a: 21 (definition in Spongiidae, invalid subsequent designation of type species). — de Laubenfels, 1948: 59 (erroneous reference to first publication, wrong type species). — Bergquist, 1980b: 458 (definition, discussion, revision, wrong type species and date).

Diagnosis. “Cup-shaped, lobed, or flabellate Spongiidae with a skeletal network in which the secondary elements become very dense. The primary fibres are lightly cored and tend to become fasciculate, either where they arise out of the dense secondary network or just below the surface. The secondary fibres also frequently contain some spicule detritus, usually as a single discontinuous line of fragments. At the surface there is a thin but ordered sand armour. The texture is firm.” (Bergquist, 1980b: 458.) Oscules small, numerous, regular, often on papillae.

Remarks. It has been overlooked that *Leiosella elegans* cannot be the type species, not having been among the originally included species. *Euspongia levis* Lendenfeld is herein designated type species. The species was left in the genus by Bergquist (1980b) so that the oversight has no further consequence in taxonomy.

Leiosella caliculata Lendenfeld

Plate 14 figures 8, 10, plate 15 figures 1–5

[*Euspongia compacta*] Carter, 1882a: 106 (junior primary homonym of *Spongia compacta* Sowerby, 1806; [in part, not specimen from Port Fairy]; Wollongong, NSW; "S. Australia"; Vic.). — Lendenfeld, 1885h: 527 (old records).

Leiosella compacta. — Lendenfeld 1888: 120 (East coast). — Lendenfeld, 188: 120 (East coast). — Lendenfeld, 1889b: 210, pl. 13 figs 7 (syntype of *Euspongia infundibuliformis* Carter), 9 (Fremantle, WA).

Spongia compacta. — Bergquist, 1980b: 458 (in review, as good species).

Spongia compactella de Laubenfels, 1948: 18 (nomen novum for *Euspongia compacta* Carter).

[*Euspongia infundibuliformis*] Carter, 1886g: 374 (junior primary homonym of *Spongia infundibuliformis* Linné, 1759; Westernport Bay, Vic.).

Spongia infundibulis de Laubenfels, 1948: 20 (nomen novum for *Euspongia infundibuliformis* Carter).

Leiosella calyculata Lendenfeld, 1889a: 28 (in key, nomen imperfectum).

Leiosella caliculata Lendenfeld, 1889b: 221, pl. 21 fig. 1 (nomen correctum, for *Euspongia infundibuliformis*? Carter, undescribed hypotypes; Port Phillip Heads, Vic.). — Bergquist, 1980b: 458 (in review, as good species).

Coscinoderma concentricum Kirkpatrick, 1903b: 254, pl. 5 figs 19, 19a (off Port Elizabeth, South Africa). — de Laubenfels, 1948: 61 (as synonym of *Euspongia mathewsi* Lendenfeld).

Carteriospongia concentrica. — Bergquist, 1980b: 458 (in review).

Euspongia foliacea. — Ridley, 1884a: 378 (nec *Spongia foliacea* Esper; Torres Strait).

Leiosella foliacea. — Lendenfeld, 1889b: 219, pl. 12 fig. 12 (syntype of *Euspongia infundibuliformis*); pl. 20 figs 15, 17–18; pl. 21 fig. 5 (including Ridley's specimen and including *Euspongia infundibuliformis* Carter as synonyms; East Indies (new record)).

Lendenfeldia foliacea. — Bergquist, 1980b: 456, 458 (in review).

Phyllospongia vasiformis. — Lendenfeld, 1889b: 180 (part: pl. 28 fig. 1 only).

?*Leiosella elegans* Lendenfeld, 1889a: 27 (in key). — Lendenfeld, 1889b: 212 (Fremantle, WA). — de Laubenfels, 1948: 60 (résumé).

Material examined. Station KG 6, one specimen (F52046). Type specimens of *Euspongia compacta* Carter, *Euspongia infundibuliformis* Carter, *Leiosella caliculata* Lendenfeld, *Coscinoderma concentricum* Kirkpatrick (BMNH). Hypotypes of *Leiosella compacta*: Lendenfeld (AM and BMNH), of *Euspongia foliacea*: Ridley, *Leiosella foliacea*: Lendenfeld, *Phyllospongia vasiformis*: Lendenfeld (BMNH). Unpublished dry specimen from Victoria in Dendy Collection (BMNH).

Diagnosis. Shape irregular: radially folded (partly open) cups, hollow fronds, or conrescent ear-shaped lobes, with short, single or multiple peduncle. Outer, convex side may be regularly sculptured, rugo-reticulate, vermiculate or tuberculate. Softly to firmly rubbery; Basically dark brown-grey, with

purplish, greenish, orange-brown tinges, in life. Oscules chiefly on convex side and margins, occasionally in concavity. Ostia cribriporal or in petaloid groups. Surface smooth to micropapillate. Ectosome and choanosome as in generic diagnosis.

Description. Thick asymmetrical frond (pl. 14 fig. 8), deeply folded radially, with wide back roughly in one plain, folded forward on both sides, free left margin, right side completely folded around forming oblique cup. Main concavity deeply scooped longitudinally, with faint transverse ridges. Outer wall bears faintly scooped or rugo-reticulate pattern in places.

Greater width of main frond 7 cm outside, 5.5 cm inside, mostly truncate rim 8–14 mm wide (equal to thickness of wall). Transverse width of main concavity, from truncate bottom to back, 1.5 cm (jutting folds) to 3 cm (receding folds). Secondary cup 3 cm long along its inclined and slightly bent axis, its compressed mouth 12×25 mm wide, outer width 3.5×4 cm. Two pedicels below bottom of main cup, their axes 2.5 cm apart, one below base of small cup 5 mm long, other one, under free margin of main cup, 2 cm long, obliquely compressed. Greatest width of specimen 10.5 cm, greatest height, along longer pedicel, 6 cm. Dark brown-grey with purplish tinges in life, some areas greenish and rusty brown. Choanosome was lighter brown-grey. Concavity now dull olive-brown (2.5 Y 5/2–4), outside light greyish yellow (2.5 Y 6–7/4). Softly rubbery, now firmer.

Outer surface now smooth to finely granular and pitted. Circular oscules regularly distributed in some areas, lacking in others, mostly with regular collars (typical of genus), some, particularly on truncate rim, flush; width 0.5–1.5 mm (up to 3 mm across collars). Relief on inside granulate to finely reticulate, somewhat stronger than on outside. With low magnification, smooth areas of outer side bear very low regular conules, higher, with tips of primaries protruding, in granular areas. On inner side, relief that of periphery of main skeleton, with ectosome much receding between obtuse tips of primaries, across meshes formed by outermost secondaries. Occasional vague stellate or petaloid patterns visible with higher power, centered in meshes, not like cribripores in Lendenfeld (1889b pl. 20 fig. 15). Primaries almost straight, or moderately straggling, or in zig-zag course; mostly spaced 300–400 μ m, 30–80 μ m thick, sparsely branched, occasionally fasciculate, knotty; contain spicule fragments almost exclusively, rarely filling whole fibre. Secondaries around 25 μ m thick, straight to slightly curved, clear, pale yellow. Meshes irregular, 100–525 μ m wide. Some spicule fragments scat-

tered interstitially. Dermis around 330 μm thick, armoured with scattered to crowded spicule fragments.

Remarks. I have examined the only extant syntype of *Coscinoderma concentricum* Kirkpatrick (BMNH 1902.11.16.43, dry), next to the types and hypotypes indicated above. Though they exhibit a wide range of external shapes, I have no doubt that they are conspecific. Concave, rounded fronds, mostly partially fused, transitional to usually asymmetrical cups are the rule, also combination of cups and fronds. The outer side is often thrown into a relief of vermiculate or reticulate ridges which may be combined with mamelons or papillae. The inside is more commonly smooth, but may bear a scooped pattern, with radial and transverse ridges. Kirkpatrick's sponge is somewhat unusual in showing a more prominent relief in the convexity, but so does the new specimen. The unpublished large, dry specimen of this species from Victoria, in the Dendy Collection, here figured for comparison (pl. 15 figs 4–5), shows a regular, relatively fine decoration on the outside, similar to the one in the specimen in Lendenfeld (1889b, pl. 28 fig. 1). The thickness of the dermis is also subject to considerable variation.

Oscules may also occur in the concave side in some specimens, as one of the syntypes of *Leiosella caliculata* (BMNH 1955.4.7.3) demonstrates. This is not surprising in this genus, since ostia always seem to occur over the whole surface, i.e. on both convex and concave sides in flabellate and cup-shaped specimens. It may even occur, if the description of *Leiosella elegans* in Lendenfeld (1889b: 212) is accepted, that oscules are present only on the concave side; though (as in his description of *Leiosella caliculata*) Lendenfeld may have simply overlooked oscules on the outside.

Leiosella elegans (accepted as a good species by Bergquist, 1980b: 458) is likely to be a senior synonym (by page priority) of *L. caliculata*. The decoration on the outside of the holotype of the former, as described by Lendenfeld, is not incompatible with the range of patterns mentioned above for *L. caliculata*. On the other hand, large specimens of *Carteriospongia caliciformis* may develop a similar decoration (see above), and the synonymy of *L. elegans* with Carter's species cannot be excluded at present. The holotype of *L. elegans* could not be found during my survey of the dry type collection in London (BMNH), but it may eventually be found among the dry exotic sponges of Bowerbank which are as yet unsorted. However, there is a type slide in Berlin (ZMB 6818) which might decide this issue.

Leiosella levis (Lendenfeld)

Plate 15 figures 6, 7, text-figures 89, 90

Euspongia levis Lendenfeld, 1885h: 536, pl. 36 fig. 2 (Sydney Harbour; Broughton Island, NSW).

Leiosella levis. — Lendenfeld, 1888: 121 (Perth WA; Tas.). — Lendenfeld, 1889b: 213, pl. 12 fig. 14, pl. 15 fig. 6, pl. 20 fig. 14 (old records). — Whitelegge, 1901: 94 (Lake Illawarra, NSW). — Bergquist, 1980b: 458, fig. 7a, b.

Leiosella laevis. — Whitelegge, 1889: 183 (Maroubra, NSW).

[*Euspongia compacta*] Carter, 1882a: 106 (in part, specimen BMNH 1877.5.21.1900 only; Port Fairy, Vic.).

Material examined. Station KG 3, one specimen (F52047). Type specimens of *Euspongia levis* and hypotypes of *Leiosella levis*: Lendenfeld (AM and BMNH). Syntype of *Euspongia compacta* Carter (BMNH).

Diagnosis. Shape complex; prolific, contorted, compressed lobes and lamellae, concrescent and anastomosing, sprawling, with indistinct pedicel(s). Firmly rubbery; in life, dark grey-brown where exposed, dark yellowish beige below and in recessed portions. Oscules flush or raised on papillae. Surface micropapillate above, smooth below. Ostia in pairs, petaloid clusters, or meandering lines. Armoured ectosome about 1 mm thick, with two layers. Choanosome with regular canals of two sizes. Main skeleton almost devoid of primaries. Detritus scanty in fibres, abundant interstitially.

Description. Complex shape, of four elongate lamellae transversely folded and partly coalescent (pl. 15 fig. 6). Complex, rhizomatous pedicel below centre of first lamella, oblique to one side. If oriented in growth position, with base of pedicel flat on bottom, rhizomes facing forward-left, lamellae are increasingly inclined backwards, almost recumbent, staggered, completely coalescent on right side, partly coalescent (backs to lower fronts) in centre and left. First interstice hollow, with small round lacuna through base; second interstice with three elongate lacunae, third open on left side; third interstice with continuous meandering lacuna from open left side to centre. Some lamellae, particularly first one, have transverse ridges on front, some more prominent, incipient secondary lamellae. Base, beyond pedicel, has only slight rounded swellings and hollows, except open lacunae on one side, and two closed small lacunae off-centre.

Width of specimen (length of the lamellae) 10–11 cm, depth in centre (across lamellae) the same; height of main body (perpendicular) 3–3.5 cm; pedicel 1.5 cm high, its base 7.5 \times 2.5 cm.

Dark grey-brown in life, largely preserved in alcohol (10 R 4–5/1–2). Base dark yellowish beige



90

Figure 89, 90. *Leiosella levis*. Details in reflected light. Figure 89. Perpendicular section (surface on top and right), $\times 6.2$. Figure 90. View of surface showing ostia frequently grouped in petaloid fashion, $\times 12.5$.

(2.5 Y 7-8/2-4). Firmly rubbery. Oscules on all upper, dark surfaces, including pedicel, more numerous on fronts and ridges of lamellae, always collared, some conical, with transverse ridges on backside, occasionally connecting neighbouring oscules. Collars and ridges distinctly paler.

Surface between oscules finely granular to unaided eye, that of base smooth. With low magnification, upper surface shows regular primary reticulation of sandy ridges (meshes 0.5-1 mm wide). Conspicuous ostia in depressions, mostly in pairs or in petaloid clusters (text-fig. 90), or in meandering short rows, with flush sandy interstices forming secondary meshwork. Primary meshes frequently indistinct. Petaloid groups more frequent

and regular on lower side, where some areas smooth, with single ostia or none.

Canal system in periphery regular (text-fig. 89), with primary, ascending canals, 400-670 μm wide, spaced 2-2.5 mm, and anastomoses around 400 μm wide, spaced 0.8-1.6 mm. Secondary canals 65-130 μm wide, frequently fasciculate.

Main skeleton almost devoid of primaries. Few portions of thicker fibres contain debris. Secondary skeleton in great disorder, with tangled fibres 15-30 μm thick, twisted, interlocking, barely discernible meshes 35-440 μm wide. Few vague fascicles in different directions. Much mixed detritus scattered interstitially, crowded around walls of canals.

Armoured ectosome of two layers: (1) outer one,

320–420 μm thick, packed with debris, including many coarse sand grains; (2) inner one, 320–580 μm thick, with numerous crypts, crowded mixed debris (chiefly spicule fragments).

Thorectidae Bergquist, 1978

Synonyms.

Irciniidae Gray, 1867 (nomen oblitum).

Stelospongiinae Lendenfeld, 1889a, 1889b (nomen oblitum based on genus dubium).

Stelospongiidae: Topsent, 1928 (nomen oblitum).

Remarks. Irciniidae was published in one of the most influential early papers on systematics of intermediate taxa of sponges. It is regrettable that Bergquist disregarded the availability of this senior synonym. Thorectidae, like Oceanapiidae (see above), but unlike other family names, found general acceptance in the short period since its introduction. Stelospongiidae was originally applied (as subfamily) to *Stelospongia* sensu Lendenfeld (species of *Fasciospongia*, *Smenospongia*, *Cacospongia*, *Dysidea*, *Thorecta*, *Hyattella*, *Ircinia*, “*Psammocinia*”, fide Bergquist, 1980b), and *Ircinia* sensu Lendenfeld (mostly *Ircinia* s.l.). *Thorecta*, *Thorectandra* and *Aplysinopsis* were included in the Aplysininae by Lendenfeld (1889b). Topsent (1928: 70) included in the Stelospongiidae species now ranged in *Cacospongia*, *Hyrtios*, *Ircinia* s.l. Most species included by Bergquist (1980b) in the Thorectidae were assigned by de Laubenfels (1948) to the Spongiidae, partly to the Spongiinae (those now in *Hyrtios*, *Ircinia* s.l.), partly to the Verongiinae (those now in *Cacospongia*, *Thorecta*, *Fasciospongia*).

Ircinia Nardo

Ircinia Nardo, 1833, col. 519. — Vacelet et al., 1976: 102, 103 (discussion of widely distributed Indo-West Pacific species). — Wiedenmayer, 1977a: 60 (synonymy with further references; for *Euircinia* read *Euricinia*; nomen negatum [for *Ircinia*, read *Jrcinia*], nomina vana; clarification of type species, revised diagnosis, West Indian species). — Van Soest, 1978: 33, 41 (definition, discussion, revision of West Indian species). — Bergquist, 1980b: 464 (synonymy, definition, discussion, revision).

Sarcotragus Schmidt, 1862: 35. — Wiedenmayer, 1977a: 60 (as synonym of *Ircinia*, further references). — Bergquist, 1980b: 466 (as good genus).

Psammocinia Lendenfeld, 1889b: 579 (as subgenus of *Ircinia*). — Bergquist, 1980b: 468 (as good genus).

Diagnosis. Thorectidae in which the primary fibres frequently attain great size by being woven into complex fascicles. Sand extremely variable in abundance, coring or charging primaries, or all fibres, often occurring also in matrix of choanosome and in ectosome, occasionally rare or absent. The matrix is commonly charged with fine collagenous

filaments. These are usually terminally knobbed, of variable length (order of one to several mm) and thickness (below 1 μm up to 29 μm , commonly 5–15 μm). They may be scattered or bundled, often forming a dermal or subdermal reticulum, and may be scarce in some species. Surface conulose, tuberculate, or pitted. Consistency tough to firm, sometimes brittle.

Remarks. I do not think it is realistic to separate *Psammocinia* as a genus or even subgenus from *Ircinia*. It is not uncommon in this group (*Ircinia* “sensu lato”) to find specimens (species) with an armoured ectosome, in which choanosomal detritus occurs in primary fibres only, or sparsely also in secondaries. This is the condition of most West Indian ircinias (van Soest, 1978), and it characterises the Australian *Ircinia lendenfeldi* (senior synonym of *I. jacksoniana*). In *Ircinia arenosa* Lendenfeld, a good species of *Psammocinia* according to Bergquist (1980b), sand is present only in the ectosome and in the fibres, not interstitially, if Lendenfeld’s figure (1889b, pl. 36 fig. 3) and description can be trusted. The presence of very large sand grains, “coated individually with spongin, and linked to the skeletal fibres by spongin strands”, mentioned by Bergquist (1980b) in her diagnosis of *Psammocinia*, is probably a monotypic character, of no importance on this systematic level. A similar condition is illustrated by Lendenfeld (1889b, pl. 36 figs 4, 5) for *Ircinia lendenfeldi* (as *irregularis*), regarded as a good species of *Ircinia* by Bergquist (1980b: 466, as *jacksoniana*).

Vacelet (1959: 89) regarded *Sarcotragus* as a subgenus of *Ircinia* conditionally: valid only in the event that the congruence of thin filaments (below 2 μm) and pithed fibres without detritus in two Mediterranean species (*I. spinosula* and *I. muscarum*) could be extended to other species, in other parts of the world. Bergquist’s diagnosis of *Sarcotragus* is weakened in this respect by admitting primary fibres with scarce detritus and filaments up to 5 μm thick. She included, besides *spinosula* and *muscarum* (both recorded by Lendenfeld from Australia, but remaining to be verified as such), the Australian *I. australis* (senior synonym of *I. arbuscula*). This, according to Lendenfeld (1889b) has detritus only as a discontinuous core in primaries, and filaments 6 μm thick. Four West Indian species described by van Soest (1978) have filaments of 6 μm in diameter and below (down to 1 μm in *I. strobilina*), armoured dermis, and detritus in most fibres, sparse except in *I. felix*. *Ircinia arenosa* was described by Lendenfeld as having filaments 2–2.5 μm thick.

In conclusion, the characters purported as diag-

nostic for *Sarcotragus* and *Psammocinia* by Bergquist (1980b) are either differences of degree, mono/oligotypic, or incongruent with her distribution of species, and thus diataxonic.

***Ircinia caliculata* Lendenfeld**

Plate 15 figures 8–10, plate 34 figures 5, 6,
text-figure 91

Hircinia caliculata Lendenfeld, 1888: 180 (nomen imperfectum; West coast, WA; Illawarra and Sydney Harbour, NSW). — Whitelegge, 1889: 184 (off Shark Island, Sydney Harbour).

Hircinia (Sarcotragus) caliculata. — Lendenfeld, 1889a: 62 (in key).

Hircinia (Sarcotragus) caliculata. — Lendenfeld, 1889b: 572 (nomen correctum, old record).

Hircinia caliculata. — Whitelegge, 1901: 116 (Tuggerah Beach, NSW).

Hircinia campana. — Lendenfeld, 1888: 178 (part, nec Lamarck, Australian record only; Sydney Harbour). — Whitelegge, 1889: 184 (off Green Point, Sydney Harbour).

Hircinia (Sarcotragus) campana. — Lendenfeld, 1889b: 569, pl. 28 fig. 3 (part, nec Lamarck; old record).

Ircinia campana caliculata. — de Laubenfels, 1948: 71 (résumé).

Ircinia caliculata. — Bergquist, 1980b: 466 (in revision, as good species).

Material examined. Station KG 5, one specimen (F52049). Syntypes of *Hircinia caliculata* Lendenfeld (BMNH).

Diagnosis. Thick-walled, blunt-rimmed cups, frequently open on one side, or concave fronds, with multiple pedicel. Firmly rubbery, tough; variable shades of greyish red to orange in life. Strong rugoreticulate sculpture may be present on outer (convex) side. Whole surface finely and regularly papillate. Small oscules numerous in convavity. Ectosome armoured, 250–400 μm thick, packed with detritus. Choanosome dense, with much interstitial detritus. Main skeleton lax, irregular, little fasciculate, thicker fibres generally loaded with detritus. Filaments numerous, tangled, with irregular, indistinct heads.

Description. Erect concave frond supported by strong, two- or threefold pedicel attached to granite cobble (pl. 15 figs 8–9). Frond broadly tongue-shaped, 5.5–6 cm wide at base, folded around on sides, more so on right (viewed from concave face), forming widely open compressed cup. Almost flat central part of frond tilted backwards, 12 cm in greatest height, along its axis. Greatest width, across lateral folds, in upper third, 11 cm. Margin of frond has three round notches, one on left, two plus round hole on right. Thickness of frond 1.5

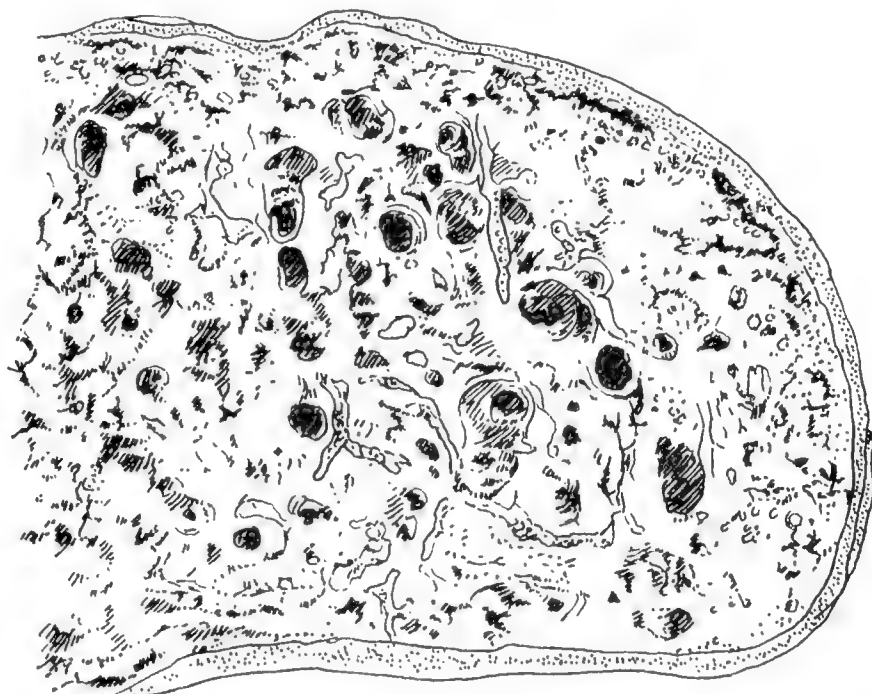


Figure 91. *Ircinia caliculata*. Perpendicular section in reflected light, showing armoured ectosome, canal system, and part of the skeleton, $\times 8.3$.

cm near base, about 1 cm near rim (at one point only 4 mm).

Bottom of concavity juts forward slightly. Complex pedicel below this expands slightly towards base, comprises stout, somewhat compressed pillar on left, 17×22 mm thick in middle; more compressed twofold pillar on right, with round hole in centre, 7 mm wide in front, 13 mm in back, 38 mm on side, across hole. Arch separating main pillars in front horseshoe-shaped, 15 mm wide and high. Space between pillars at back much higher, about 6 cm to where pillars merge with inclined back of frond. Bases of pillars extended into irregularly curved rhizomes, anastomosed at back, clinging to cobble $8.5 \times 4 \times 4$ cm. Massive base, between upper concavity and arch between pillars, penetrated obliquely from left by deep, almost terete concavity, now partly dissected.

Upper part of back of frond decorated by conspicuous rugo-reticulate pattern, with sharply outlined meshes mostly 5–10 mm wide, narrower (2–3 mm) just below rim. Pattern irregular below and on outside of stronger lateral frond, comprising shallow pits and meandering grooves about 7 mm wide.

Colour in life complex: dull greyish red in concavity (10 R 6–7/2), greyish orange on upper back and sides (2.5 YR 7/2–4), lighter, purer orange on lower back, sides and pedicel (5 YR 8/8 to 7.5 YR 9/4). Choanosome was dark brownish orange (YR 6/8). Colours changed little in alcohol. Firmly rubbery, tough in life and in alcohol. Most of surface (including rugae and depressions on back) regularly papillate (conulose), like goose-skin or somewhat denser. Pattern weaker in parts of concavity, much of upper margin almost smooth. Conules around 1 mm wide and up to 1 mm high.

Concavity riddled by oscules, more regularly arranged and smaller above and on left, often clustered near bottom and in right fold. Their width 0.6–1.2 mm above/left, 0.2–0.5 mm below/right, interstices mostly 2–5 mm.

With low magnification, fine rugo-reticulation all over outer surface and peduncle, nervures occasionally forming indistinct radial pattern over conule tips, fine ostia crowded in meshes. Exhalant concave surface contains much smaller oscules (about $50 \mu\text{m}$ wide) regularly scattered between larger ones.

Armoured ectosome $250\text{--}400 \mu\text{m}$ thick (text-fig. 91), with packed spicule fragments dominating in outer half, coarse sand grains crowded below. Similar segregation in choanosome: spicule fragments crowded around walls of larger canals, coarse sand grains and few spicule fragments scattered interstitially. Choanosome riddled by terete, annulate

canals, $300\text{--}1000 \mu\text{m}$ wide, spaced 0.3 to 2 mm. Discontinuous subcortical crypts.

Main skeleton lax and irregular meshwork of thick, knotty, straggling fibres, mostly $100\text{--}250 \mu\text{m}$ thick, with meshes around 1–2 mm wide. Commonly little distinction of primaries and secondaries, as almost all fibres contain much mixed detritus, but ascending fibres often more knotty and lacunose. Fibres occasionally in loose fascicles. Few thinner fibres, around $50 \mu\text{m}$, with few or no foreign inclusions.

Numerous filaments (pl. 34 fig. 6) tangled, often grouped in strands, 4 to $6.8 \mu\text{m}$ thick; their heads scarce, irregular, often angular, $9\text{--}14 \mu\text{m}$ wide. Filaments almost always coated with brown, finely speckled pattern, similar to that noticed on inner fibres of *Carteriospongia silicata*. Length of rare clear filament $540 \mu\text{m}$.

Remarks. Of the two descriptions in Lendenfeld (1889b), the one under *Hircinia campana* fits the present specimen better. The other one, under *H. caliculata*, mentions oscules 0.3 mm wide, "scattered over the outer surface of the cup-shaped sponge." He possibly confused the outer with the inner surface. However, the dry syntype of *H. caliculata* from Illawarra, here figured for comparison (pl. 15 fig. 10) resembles the new specimen sufficiently in external shape.

Several species of *Ircinia* with Australian records have been accepted as valid by Bergquist (1980b: 466; see Wiedenmayer et al., in press, for further data). Of those common in southern Australia, *I. rubra* Lendenfeld (common in New South Wales) is dark red in life, commonly small to medium-sized, cup-shaped or lamellate, but, in contrast to *I. caliculata*, always thin-walled, soft, and has detritus only in the primary fibres. *I. australis* Lendenfeld (with *I. arbuscula* Lendenfeld as junior synonym) is multilobed, each lobe with an apical oscule, the surface covered by dense, pointed conules; with little detritus, in primaries only. *I. irregularis* (Polejaeff) (with synonym *I. gigantea* Lendenfeld) is massive, often cake-shaped, large, dull orange to fawn in life, with dark brown oscules clustering on top, and coarse, blunt conules in life, and is internally very cavernous. It is common in northern Australia, New South Wales, and St Vincent Gulf, South Australia (Bergquist and Skinner, 1982, pl. 2 fig. 1).

Ircinia lendenfeldi de Laubenfels (1948: 77; for *I. irregularis* Lendenfeld, nec Polejaeff, with synonym *I. jacksoniana* Bergquist) has been recorded only from New South Wales. It is massive-lobate, with blunt conules connected by ribs, "dirty light brown" externally, "intensely orange-yellow" inter-

nally (fide Lendenfeld, 1889b: 579). The filaments are described as "very stout" (10 μm thick). The ectosome is described as armoured, with detritus forming a banded reticulum, the oval membranaceous meshes being cribriporal.

Ircinia halmiformis, as described by Lendenfeld (1889b: 586, pl. 27 fig. 9) from the West Coast, has the shape of a folded lamella, with folds being radial and dendritic. The surface seems to be pitted (in the photograph of a wet specimen; Lendenfeld described it as smooth). The sand grains are in columns, but individually coated by spongin and connected by short, straight fibres.

Ircinia arenosa Lendenfeld (1889b: 583, pl. 36 fig. 3) was described as regularly cup-shaped, often tall and pedunculate; with walls around 1 cm thick, surface smooth, except for irregular rugae on the outside of large specimens; colour in life brownish pink; with sand in ectosome and all fibres, but not interstitially; and with filaments 2–2.5 μm thick. It was recorded by Lendenfeld from the West Coast, from Port Phillip Heads, and from Port Jackson (here in 20–50 m depth).

Ircinia rugosa Lendenfeld (assigned to *Psammocinia* by Bergquist, 1980b) is here regarded as a nomen dubium, pending revision of the composite type series in the BMNH (unpublished Carter/Wilson material from Port Phillip Heads), designation and redescription of a lectotype.

Thorecta Lendenfeld

[*Geelongia*] Carter, 1885c: 306 (nomen oblitum). — Bergquist, 1980b: 468, 470 (as synonym of *Thorecta*, discussion, type species redescribed).

Thorecta Lendenfeld, 1888: 142. — Lendenfeld, 1889b: 336. — de Laubenfels, 1936a: 25 (definition, invalid designation of type species). — de Laubenfels, 1948: 107 (valid designation, but misinterpretation of type species, erroneous revision). — Bergquist, 1965: 128 (discussion). — Wiedenmayer, 1977a: 70 (erroneous synonymy, clarification of type species, misidentification of West-Indian material). — Bergquist, 1980b: 468 (revision, review).

Antheroplax Lendenfeld, 1889a: 24 (definition as subgenus of *Phyllospongia*). — Lendenfeld, 1889b: 168, 171 (part: type species, *Geelongia vasiformis*, only, not 8 other included species). — de Laubenfels, 1948: 123 (designation of type species, but neotype designation invalid).

Thorectandra Lendenfeld, 1889a: 41. — Lendenfeld, 1889b: 369. — de Laubenfels, 1936a: 26 (designation of type species). — de Laubenfels, 1948: 107 (merged in *Thorecta*). — Bergquist, 1980b: 472 (retained, synonymy, definition, revision, invalid designation of type species).

Halispongia. — Bowerbank, 1872: 123 (nec Blainville).

Diagnosis. Thorectidae in which the primary fibres are cored with a regular axial column of debris and the secondary fibres are clear. The skeleton forms

a regular, almost perfectly rectangular meshwork in which the spaces between the fibres may be quite large (up to 4 mm) and primary fibres are up to 0.3 mm thick. The surface is always armoured, and may be smooth, conulose, or thrown into ridges and hollows. Shape commonly stalked, globose to flabellate, but also tubular, lobose, or caliculate. Mucus production common, especially in species with widely spaced fibres. (Combined after Bergquist, 1980b: 468, 472.)

Remarks. The definitions given by Bergquist (1980b) for *Thorecta* and *Thorectandra* differ only by degrees. External shape and mucus production are hardly useful in practice as diagnostic criteria. This is best exemplified by two of the species described below, one new, and one misidentified (as being a haplosclerid) in Bergquist's revision. In both, the dimensions of the fibre reticulation and the rugo-reticulation of the surface are intermediate and the two species could equally well be placed in either genus. In one of the specimens of *T. choanoides*, furthermore, fibre diameters generally fit the values given by Bergquist for *Thorecta*. Production of slime is a variable trait even within a species (*Thorecta choanoides*, see below). De Laubenfels' merger of the two genera is therefore upheld.

Thorecta choanoides (Bowerbank)

Plate 16 figures 1–3, plate 35 figures 1, 2

Halispongia choanoides Bowerbank, 1872: 123, pl. 6 (Fremantle, WA). — de Laubenfels, 1948: 109, 114 (as synonym of *Thorecta boleta* [recte *boletus*] (Lamarck)).

Thorectandra choanoides. — Lendenfeld, 1889b: 373, pl. 34 figs 1, 6–7 (old record). — Bergquist, 1980b: 464, 472, figs 10d, 14c (in review, as good species).

Stelospongos latus (*Stelospongos flabelliformis* var. *lata*). — Carter, 1885c: 306 (part: BMNH 1886.12.15.219 only; Port Phillip Heads, Vic.).

Stelospongos flabelliformis. — Dendy, 1889a: 325, pls 30–33 (Port Phillip Bay).

Material examined. Station KG 9, two specimens (F52050, F52051). Paralectotype of *Stelospongos latus* Carter (BMNH). Hypotype of *Stelospongos flabelliformis*: Dendy, 1889a (NMV).

Diagnosis. Often stalked, body globular, lobate, or thickly flabellate. Surface more or less sculptured, coarsely rugo-reticulate, vermiculate, brain-like, or conulose. Oscules conspicuous, often elevated, single and apical on lobes, with smooth, blunt or tabulate rims. Sand armour in ectosome variable in thickness, thickest on ridges and oscular rims, then brittle; may be lacking in lower and depressed parts, ectosome then often deciduous after collecting. Firmly rubbery to spongy, stem

little compressible; often slimy. Grey with reddish to orange tinges on surface in life; in unarmoured depressions and choanosome bright yellow, with dark reddish grey fibres. Choanosome commonly dense, becoming viscous, flowing out after collecting in some specimens. Main skeleton typically regular, but mesh size variable, tighter below surface ridges.

Description. F52050 better preserved (pl. 16 fig. 1), more elegant, with terete, slightly bent stem gradually expanding into main body, in size and shape like fist or lion's paw, but conical below, somewhat compressed, ending in irregularly fanning cluster of partly coalescent, slender conical processes with apical oscules. Stem 6.5 cm high, 1 cm thick, with sprawling, rhizomatous base 5×8.5 cm wide. Greatest width of body, in upper third, 10.5 cm, depth 5 cm in middle, total height of specimen 22 cm.

F52051 poorly preserved, lower half largely macerated, upper part squashed. Originally like a tree, with stocky compressed stem 18–28 mm thick in middle and 5 cm high, rhizomatous base 4×8 cm wide. Slightly compressed body 10×12 cm wide, distally vaguely divided into 5 broad, largely concrescent lobes with apical oscules. Most of surface of body thrown into coarse rugo-reticulate to cerebroid pattern, with blunt ridges, 3–4 mm wide and deep, contorted pits of similar dimensions, or narrower meandering grooves.

Surface of F52050 more elaborate, also rugo-reticulate, but with narrow, sharp ridges often interrupted, polygonal depressions thus confluent. Ridges commonly 1–2 mm wide, up to 4 mm deep. Some areas, particularly near top, have fewer depressions and wide conulose areas. Some ridges near top smooth, conspicuously sandy. Conules below oscules generally 1–2 mm apart, frequently macerated, with tips of primaries protruding. Oscular chimneys 2–4 cm high, 1.5–2 cm wide at base, 1–1.5 cm wide at top, with collared oscules 0.5 to 1 cm wide.

In F52051, free ends of osculiferous lobes 3–4 cm wide, with oscules 8–12 mm wide, surrounded by wide, flat collars. F52050 in life light grey with reddish to orange tinges (10 R 9/2 to 7.5 YR 7/2) on ridges and oscular collars, pale lemon yellow in depressions (5 Y 9/8). Sandy surface over most of body of F52051 with similar greys, but darker; other areas, already partly macerated before preservation, showed dark reddish grey fibres, and bright yellowish orange choanosome (7.5–10 YR 8/12). Profuse slime of similar colour from this specimen after collecting, no conspicuous exudate in F52050. Alcohol of F52050 stained brownish orange, that of F52051 deeper brown-red. F52050 rubbery,

firmer, barely compressible in stem. F52051 more spongy on top, with brittle skin easily broken, stem more compressible than in F52050. Surface of stem in F52050 more finely conulose than on top, with conules aligned in anastomosing ridges. On top of F52051, fine rugo-reticulate meshwork superimposed on coarse folds and grooves, with ridges and pits both 0.5–1 mm wide, the latter corresponding to skeletal ostia.

Better preserved surface of body of F52050 not as coarsely and thickly encrusted with sand as that of F52051 (where ectosome is about 1 mm thick). Low magnification shows evenly speckled pattern, like leopard skin, all over depressions, formed by reticulation of fine ridges packed with sand, whitish in reflected light, outlining sinuous, often vaguely petaloid, darker, slightly recessed interstices, in which translucent ectosome, lightly armoured with spicule fragments and fine sand grains, overlies vestibules. Dark inhalant fields about 100–300 μ m wide, fine ridges between them 50–70 μ m wide. Spaces subdivided by groups of spicule fragments and single sand grains outlining ostia 50–100 μ m wide. Near primary (coarse) ridges and around isolated conules, secondary ridges (of reticulum) wider, radial around some conule tips, with dark interstices smaller.

Concave depressions between primary ridges occasionally traversed and raised by underlying outermost secondary fibres of main skeleton.

In lower, conical part of body of F52050, now mostly macerated, main skeleton very lax below primary depressions, with few secondaries and rare primary fibres in periphery, down about 5 mm. Main skeleton below main ridges of surface much denser, as in deeper choanosome.

On top of F52050, ectosome packed with mixed detritus, 400–500 μ m thick on primary ridges, 100–150 μ m over inhalant concavities. Choanosome dense, contains numerous globular microsymbionts with granular surface, 12–17 μ m in diameter. All fibres yellow, stratified, primaries 80–160 μ m thick, regularly and thickly cored by mixed detritus. Few sand grains and spicule fragments reach surface, occasionally bulging, but always enveloped by spongin. Spacing of primaries in deeper choanosome mostly 500–1500 μ m. Secondaries always clear, 30–100 μ m thick, occasionally branched, irregularly spaced 300–1000 μ m.

Remarks. The specimen of *Stelospongos flabelliformis*: Dendy, 1889a (F52215) (about half of the body cut off and now missing) was obviously thickly flabellate, and resembles the paralectotype of *Stelospongos latus* Carter (here figured for comparison, pl. 16 figs 2–3). The primary rugo-reticulation of the surface on both faces is similar

to that in F52050, but the ridges are more discontinuous, almost dendritic, with labyrinthic depressions. This pattern becomes finer towards the edge of the body, radially oriented on one face, dissolved into aligned conules on the other. The edge itself, bearing the oscules, is mostly truncate, speckled with depressed, sharply rimmed inhalant fields. The elevations on the edge, all the ridges on both faces, and the pedicel are encrusted with distinctly coarser sand than the depressions. The thickness of the ectosome is intermediate between those in the new specimens. Spacing of primaries is in the general range 0.5–2.5 mm.

Of the valid species recognised in *Thorecta* and *Thorectandra* by Bergquist (1980b) and myself (Wiedenmayer et al., in press, with clarification of Bergquist's confused revision), several are stalked and distally massive or flabellate, chiefly recorded from southern Australia.

Thorecta farlovi (Hyatt, 1877; with junior synonym *Stelospongia flabelliformis* Carter, see below, Remarks on *Fasciospongia rimosa*) is consistently flabellate, more or less symmetrical. Its salient diagnostic traits are the coarse rugo-reticulate to—vermiculate pattern on both faces, the margin with prominent radial atria and distal oscules, the pedicel commonly compressed in the plane of the frond, and the scantily armoured, mostly deciduous ectosome.

Thorecta latus (Carter, 1885c, here restricted to lectotype BMNH 1886.12.15.218; with junior synonyms *Stelospongia cribrocrusta* Carter, 1886g, and *Thorecta exemplum* varr. *secunda* and *tertia* Lendenfeld) is chiefly pedunculate-pyriform, occasionally compressed, biconvex-flabellate, with smooth surface, finely clathrate ectosomal armour, which is more conspicuous in dry specimens. It may resemble *Coscinoderma pesleonis* externally (see above). *Thorecta boletus* (Lamarck, with synonym *Thorectandra corticatus* Lendenfeld) is thickly club-shaped, truncate above, with single apical oscule. Its surface with thick armoured ectosome is regularly and coarsely rugo-reticulate on the sides, and the main skeleton is coarse. *Thorecta typicus* (Carter, see Bergquist, 1980b, figs 11a, b) is symmetrically flabellate, with elliptical frond of even thickness, apical-marginal oscules, both faces with vague tuberculate and rugo-vermiculate sculpture, armoured ectosome thick and conspicuously clathrate, coarse main skeleton.

Thorecta glomerosus sp. nov.

Plate 16 figures 4, 5

Holotype: NMV F52052, Station KG 7 (Tasmania, North Point of East Cove, Deal Island, Kent Group; depth 25–30 m, rock face below algal forest).

Diagnosis. Globose, softly spongy, slimy, pale orange-brown in life. Conspicuous oscule single, apical, collared. Surface smooth to finely conulose and rugo-reticulate. Ectosome thin, mostly lightly armoured to soft, largely deciduous, as for choanosome. Main skeleton very regular, spacing of primaries chiefly 2 mm, all fibres pale.

Description. Originally almost spherical, slightly compressed on one side, now flattened by own weight. Lower end slightly drawn out into short neck, where torn from base of attachment. Single very conspicuous collared oscule on top. Greatest width of specimen 8.5 cm, height 9 cm. Broken neck at bottom 1.5 × 2.5 cm. Oscule 1.5 cm wide at rim, collar 4–5 mm high.

Deep brown in life (2.5 YR 4–5/4) with sharply outlined greenish-grey patches on one side. Much light brown mucus emitted upon collecting, partly macerated surface then pale orange-brown (5 YR 7/4–6). Softly spongy then as now.

Some smaller, flush oscules, 2–3 mm wide, scattered in lower part of specimen. About half of surface now partly or totally macerated. Elsewhere, as in life, three types of surface structures:

(1) smooth, (2) fine rugo-reticulation with irregularly square to polygonal meshes 0.5–1 mm wide, and (3) rugo-reticulation combined with conules, the former occasionally feeble and discontinuous, the latter up to 2 mm high, 1–3 mm apart.

At low magnification, type 1 merely better preservation of type 2, with lightly armoured outer ectosome masking subjacent tangential reticulation of trabeculae packed with debris. Recessed interstices in types 2 and 3 now mostly open, often with central round pore, due to contraction of dermal membrane. Cribripores occasionally preserved. Densely armoured, lower reticulate ectosome probably discontinuous in life, large areas merely covered by dermal membrane with scattered detritus.

Surface types 2 and 3 with trabeculae of ectosome packed with ill-sorted mixed detritus, lithic grains (up to 600 µm wide) dominating, to depth 700 µm. In recessed interstices, ectosome 300 µm thick, with crowded detritus better sorted, proportionately more spicule fragments, smaller lithic grains. Main skeleton very regular at low magnification, with primaries spaced 1.4–2.5 mm (2 mm prevailing), 110–200 µm thick, and clear secondaries, 37–120 µm thick, spaced mostly 1–4 mm. Primaries occasionally branch, thickly cored, rarely filled, with ill-sorted mixed detritus. Spicule fragments often disoriented, with one or both ends protruding, always enveloped by spongin. Fibre contours thus commonly knotty or serrated. Secondaries clear, frequently branch and anastomose;

junctions with primaries commonly trumpet-shaped. All fibres pale.

Remarks. The new species is distinct from most "carved" congeners ("*Thorectandra*") by having a finer, more regular and weaker surface pattern, a trait shared with *T. tuberculatus*, from which it differs by its large apical oscule, globose shape, relatively weakly armoured ectosome, and the more regular reticulation of pale fibres.

Thorecta tuberculatus (Carter)

Plate 16 figures 6, 7, 10, plate 35 figures 3-5

Stelospongia? tuberculatus Carter, 1885c: 306 (Port Phillip Heads, Vic.). — de Laubenfels, 1948: 117 (as synonym of *Thorecta murrayi* (Polejaeff)).

Thorecta tuberculatus. — Lendenfeld, 1889b: 369, pl. 33 fig. 12 (redescription of holotype). — Bergquist, 1980b: 470 (in review, "unrecognisable except as a haplosclerid sponge".)

Material examined. Station KG 5, one specimen (F52053); station KG 6, one specimen (F52054); station KG 7, one specimen (F52055). Holotype of *Stelospongia? tuberculatus* (BMNH).

Diagnosis. Irregularly lobate, often with short, irregular pedicel(s). In life, grey with brownish, greenish and purple tinges above; beige to dull yellow in depressions and below. Choanosome brownish orange to peach (fibres orange-brown). Firmly rubbery, slimy. Surface smooth to finely papillate, or rugo-reticulate. Few small oscules on top. Armoured ectosome variably thick, may be absent below, thickest on top (up to 1 mm), here with debris often forming compound reticulum, with interstitial ostia. Main skeleton less regular for genus; primaries knotty, straggling, spaced 1.5 mm.

Description. Irregularly lobate. In F52053 (pl. 16 fig. 10), 3 larger aligned lobes and smaller inclined lobe laterally conerescent, fifth lobe, jutting from others, free above its constricted base. Smallest, conerescent lobe clavate, others fungoid, bulbous on top. Two short pedicels, one below free lobe, the other, composite and compressed, below largest two lobes. Specimen 4 cm high, 3.5 × 6.5 cm wide.

F52054 comprises (1) thick lamella, with irregular folds inside, 4 cm high, 5.5 cm wide; (2) compressed lobe, 5 cm high, 2 × 3.5 cm wide on top, 1.5 cm at base; (3) erect digitate process, 1.5 cm high, 5 mm wide; all connected proximally by thin base.

F52055 comprises two stalked lobes with intertwined and conerescent pedicels. Both lobes compressed in same plane, with digitate portions arranged in candelabra-fashion but largely fused

laterally, free ends protruding only from taller lobe. Height 5 and 7 cm, greatest width of lobes 2.7 and 3.3 cm, their depths 1 and 1.5 cm. Width of whole specimen 5.7 cm.

In life grey with brownish, greenish and purple tinges (5-10 R 6/2 to 7.5 YR 7-8/2) on exposed parts, beige to dull yellow (10 YR 8/6 to 5 YR 2/9) in recessed parts. Choanosome brownish orange to peach-coloured. Firmly rubbery. Few round, flush oscules scattered on top. As in *T. glomerosus*, surface may be smooth, papillate (conulose), or finely rugo-reticulate to unaided eye. Latter surface type only locally on top of larger lobes in F52053, with primary pattern of light grey ridges, 0.5 mm wide, connecting papillae (conules) mostly 1 mm high, 1-2.5 mm apart. Secondary, finer rugo-reticulation superimposed, with little relief. Numerous ostia commonly crowded in square to polygonal fields in meshes of secondary reticulum. Individual ostia often separated by thin bridges of single sand grains or spicules, forming tertiary ectosomal reticulum; but not consistently developed, with many inhalant fields confluent, petaloid. Latter pattern (secondary reticulation only) on almost whole surface of F52053, where armoured ectosome best developed and continuous. In other specimens, parts of surface now macerated, without armoured ectosome in life, tips of primary fibres protruding from many conule tips. Primary ridges occasionally formed by alignment of conules. Areas with large, round to square or contorted-elongate skeletal ostia (interstices of secondary ectosomal reticulum) alternate with clusters of much finer skeletal ostia.

Top of lobe in F52053 has cortex 0.7-1 mm thick containing almost exclusively lithic grains (rare spicule fragments and shelly grains). Choanosome dense. Crowded globular microsymbionts confined to linings of canals, interstices between sand grains in cortex, and, most conspicuously, just below cortex.

Fibres orange-brown (transmitted and reflected light), often crooked to meandering. Primaries 130-185 µm thick, with mixed detritus in core of variable thickness, occasionally displaced to one side; irregularly knotty with bulging grains and protruding spicule fragments. Average spacing of primaries 1.5 mm. Secondaries clear, 60-80 µm thick, spaced 1 mm.

Remarks. *Cacospongia murrayi* Polejaeff (1884b: 57, pl. 4 fig. 3, pl. 6 fig. 8) shows considerable resemblance with the species described above, externally, and might be regarded as a senior synonym of *Thorecta tuberculatus* (as was de Laubenfels' opinion). Bergquist (1980b: 470) treated *C. murrayi* as a good species of *Thorecta*, but unfor-

unately the specimen figured by her (1980b, fig. 10a) as such is obviously not Polejaeff's holotype (BMNH 1885.8.8.27). The register number quoted by Bergquist actually belongs to the holotype of *Ciocalypa penicillus aciculata* Carter (1885c), which, however is not the figured specimen. The latter is presently unidentified. The distinctly larger size of the oscules in Polejaeff's figure (p. 4 fig. 3), in comparison to the holotype of *T. tuberculatus* and to the new specimens could be dismissed as insignificant, but the fine and thorough tertiary fibre-reticulation described by Polejaeff make the identity of the two species very unlikely.

Bergquist's misidentification of *T. tuberculatus* (as an unrecognisable haplosclerid) can only be explained with another confusion of specimens, as I cannot imagine that examination of Carter's holotype (here figured, pl. 16 figs 6, 7) could lead to such a conclusion.

Fasciospongia Burton

Fasciospongia Burton, 1934a: 602. — de Laubenfels, 1948: 118 (in part). — Vacelet, 1959: 93 (definition, discussion, revision for Mediterranean). — Bergquist, 1965: 135 (discussion). — Van Soest, 1978: 43 (definition, revision for the West-Indian Region). — Bergquist, 1980b: 472 (definition, discussion, revision).

?*Stelospongos* Schmidt, 1870: 29. — Hyatt, 1877: 528 (part). — Burton, 1934a: 602 (footnote). — de Laubenfels, 1948: 133 (subsequent designation of type species). — Bergquist, 1980b: 474 (discussion, dropped as unrecognisable).

[*Stelospongia*] Schulze, 1879a: 613 (nomen vanum; part). — Lendenfeld, 1888: 163 (part). — Lendenfeld, 1889b: 468 (part). — de Laubenfels, 1948: 132 (invalid type designation). — Bergquist, 1980b: 474 (revision).

[*Stelospongos*] Ridley, 1884a: 383 (nomen vanum; neque sensu Ridley). — Carter, 1885c: 303 (part). — de Laubenfels, 1948: 133 (invalid type designation).

Diagnosis. "Thorectidae in which the primary fibres are cored with detritus and arranged in stout fascicles which curve in plumose fashion towards the sponge surface. The secondary skeleton is clear of detritus, and the mesh is branching but regular. Sponges belonging to *Fasciospongia* emphasise a globular, tubular, cup or fan shape in which marked exhalant canals run either centrally or superficially. In the living sponge the surface has a shiny, skin-like appearance produced by the considerable collagenous deposition in the ectosomal region. Conules are multiple because of the fibre fascicles, and often truncate rather than pointed. There is only slight differential pigmentation at the surface, more frequently the colour is uniform throughout the sponge." (Bergquist, 1980b: 472.)

Remarks. Burton's (1934a: 602) qualification of

Stelospongos as a nomen nudum is incorrect: the genus name is available with the first subsequently included species (in Hyatt, 1877; see ICZN, Articles 11c(i), 12, 69a). De Laubenfels (1948) used the ludicrous stratagem for *Stelospongos*, *Stelospongia* and *Stelospongos*, repeated ad absurdum for all genera he wished to sink, of designating the same specimen as neotype of the respective type species, even though original primary types for most, if not all, species concerned were extant. Such designations are, of course all invalid (ICZN Article 75). His subsequent designations of type species for the two unjustified emendations, objective synonyms of *Stelospongos*, are also invalid. All share the same type species, *Stelospongos friabilis* Schmidt (1870).

Stelospongos is a nomen dubium, as Bergquist (1980b: 474) pointed out, since its type species is unrecognisable. Should any type material of the latter surface, or fresh identifiable material permit to synonymise *Stelospongos* with *Fasciospongia*, then the senior synonym would be a nomen oblitum and would have to be suppressed in favour of *Fasciospongia* (ICZN Article 79c).

Fasciospongia rimosa (Lamarck)

Plate 16 figure 11, text-figure 92

Spongia rimosa Lamarck, 1814 (1813–1814): 377 with varieties *columnaris* and *subclavata*; Australian Seas).

Stelospongia rimosa. — Lendenfeld, 1889b: 497, pl. 26, fig. 5 (no locality).

Thorecta rimosa. — Topsent, 1930a: 29, pl. 3, fig. 5 (2 syntypes redescribed, type of var. *subclavata* figured).

Fasciospongia rimosa. — Bergquist, 1980b: 474 (in review).

Stelospongia canalis Lendenfeld, 1888: 164 (south coast [= ?Tasmania in 1889b]; Sydney Harbour). — Lendenfeld, 1889b: 495, pl. 24, fig. 10; pl. 29, figs 2, 4, 5, 7; pl. 31, fig. 1; pl. 32, fig. 6., (old records?). — Whitelegge, 1901: 114, pl. 15 fig. 31 (2 syntypes in AM redescribed; coast of NSW, new record). — Whitelegge, 1902a: 212 (schizosyntype ex BMNH). — Bergquist, 1980b: 472, 474, fig. 14b (as synonym of *F. rimosa*, lectotype, = Lendenfeld, 1889b, pl. 24 fig. 10, refigured).

Euryspongia canalis. — Burton, 1934a: 602 (discussion, redescription of skeleton; Great Barrier Reef; Perth [as Swan River], WA).

Stelospongia flabellum Lendenfeld, 1889a: 53 (in key, part). — Lendenfeld, 1889b: 501, pl. 31 fig. 12, pl. 32 fig. 8, pl. 39 fig. 6 (part: not Carter-Wilson material (part?); Northern Territory; Illawarra, NSW; Port Phillip Heads, Vic. [Perth, WA, as Swan River, unpublished]).

Fasciospongia flabellum. — Bergquist, 1980b: 472, 474, fig. 14a (lectotype, as holotype, = Lendenfeld, 1889b, pl. 39 fig. 6), fig. 16d (in review, as good species).

Stelospongia reticulata Lendenfeld, 1889a: 53 (in key). — Lendenfeld, 1889b: 510, pl. 24 fig. 1, pl. 32 fig.

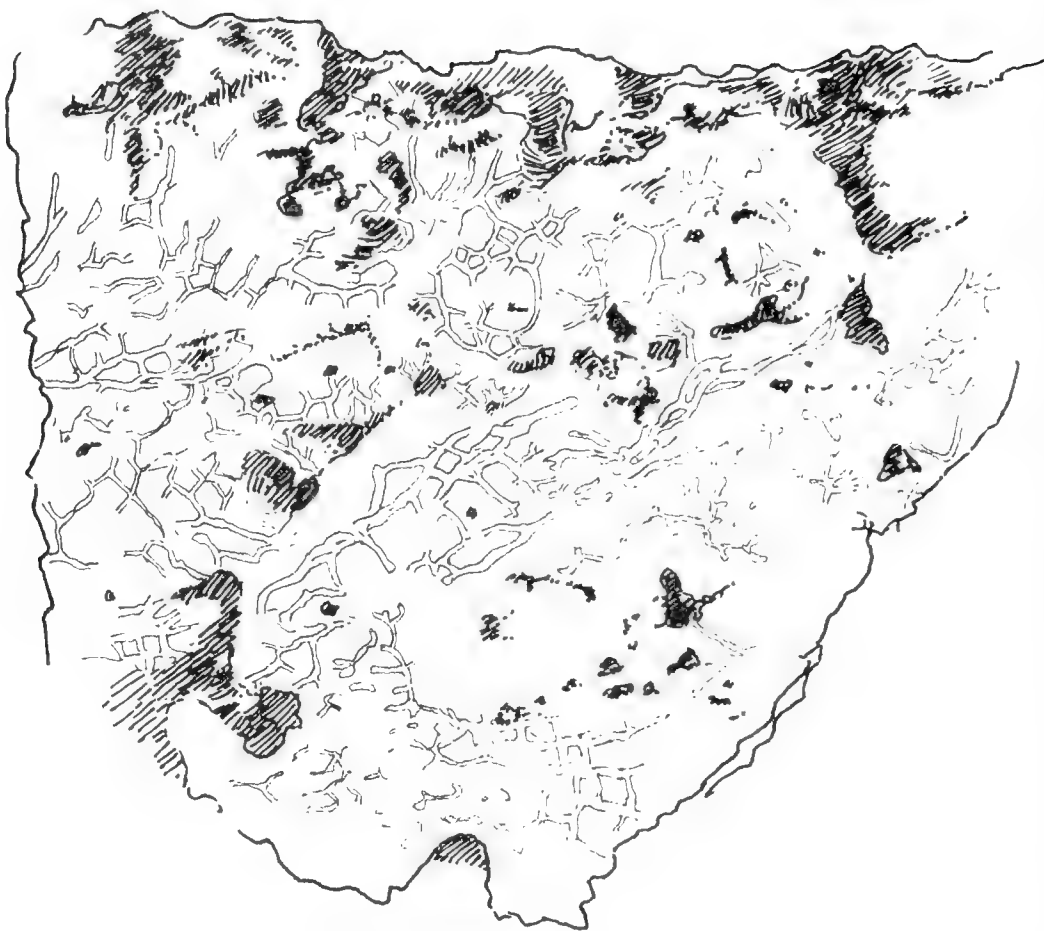


Figure 92. *Fasciospongia rimosa*. Perpendicular section showing rugose ectosome (above), canals and skeleton, $\times 8.2$.

5 (Northern Territory). — Bergquist, 1980b: 474 (in review, as synonym of *Fasciospongia rimosa*).

Stelospongia flabelliformis. — Whitelegge, 1901: 115 (nec Carter; Lake Illawarra, NSW).

Material examined. Station KG 2, one specimen (F52056). Type specimens of *Stelospongia canalis*, *Stelospongia flabellum*, *Stelospongia reticulata* (AM, BMNH). Hypotypes of *Stelospongia rimosa*: Lendenfeld, 1889b, *Stelospongia canalis*: Whitelegge, 1901, *Stelospongia flabelliformis*: Whitelegge, 1901 (AM, BMNH). Type specimens of *Stelospongia flabelliformis* Carter, 1885c (BMNH, for comparison). Hypotypes of *Thorecta farlovi*: Lendenfeld, 1889b (BMNH, for comparison).

Diagnosis. Stalked, or with short, root-like pedicel; main body irregular, lobate, con crescent-columnar or -flabellate. Top firmly rubbery, stalk barely compressible. Greyish red-brown on top, cream below in life; dull brown in alcohol. Oscules 1–8 mm wide, apical on columns, on upper margins of fronds. Terete ascending atria at surface conspi-

cous as grooves after collecting and preservation, when fleshy dermis collapses. Surface thoroughly papillate and vaguely rugose in life, distinctly conulose in preserved specimens. Choanosome dense. Main skeleton typical, primaries and fascicles often oblique. Fibres stiff, brown.

Description. Stout stalk abruptly expands into thick, complex, folded lamella above. Stalk 6–7 cm long, slightly compressed, 1.8×2 cm thick, expanding below into base 4×4.5 cm wide, inclined at 45° . Viewing specimen with inclined base backwards, main frond expands laterally from top of stalk, about evenly to mid-height, to width 10.5 cm, then higher on left side (11 cm above its base). Upper margin evenly rounded on the left, sagging and sinuous on the right. Frond longitudinally folded, extends into one secondary frond each on front and back, both attached to main frond through most of its length on both sides of

its axis. Both directed outwards at 45° to plane of main frond. Secondary frond in front much larger, projecting up to 5 cm, its inner portion as thick as main frond, 1–1.5 cm, its outer half expanding into fluted, somewhat contorted club-shaped structure up to 4 cm wide. Rudimentary lateral frond near left margin, on front of main frond, projecting up to 1 cm. Secondary frond along back projects up to 2 cm, 1 cm thick, ends 2 cm below upper rim of main frond. Total height of specimen 19 cm.

In life greyish red-brown on top (10 R 7–8/4) grading into cream or off-white below (N 9–10 (YR 1)); now uniform dull brown (7.5 YR 4–5/4). Firmly rubbery on top, barely compressible along stalk. Some clear slimy exudate upon collecting.

Oscules 1–8 mm wide chiefly on upper edges of all fronds. Many terete atria just below surface, now wholly or partially open, some still roofed completely by dermal membrane, as all were in life. These more or less pronounced grooves in surface generally arranged longitudinally, but meandering, occasionally branched downwards.

Except these marginal atria, whole surface finely papillate and variably rugose in life. Through shrinkage of ectosome, surface now more distinctly conulose. Conules 0.5–1 mm high, mostly 1–2 mm apart, irregularly distributed, frequently in clusters or aligned in ridges. Ridges connecting neighbouring conules form vague rugo-reticulation or labyrinthic pattern in some areas. Some intervening depressions bear single or branched groove at bottom, and all depressions contain irregularly clustered, indistinct ostia. Some polygonal depressions irregularly open below, like invaginations, possibly additional oscules. In transverse section (text-fig. 92) ectosome about 200 μm thick; dense choanosome traversed by canals mostly 100–1000 μm wide, and conspicuous irregular reticulation of stiff brown fibres. Primaries and their fascicles frequently oblique to surface. Primaries 150–200 μm thick, secondaries 30–120 μm . Meshsizes commonly 300–800 μm . Fascicles around 1 mm wide, irregularly spaced 1–5 mm. Primaries markedly stratified, with outer layers often wavy, and thin, straggling core of mixed detritus, including spicule fragments, comparatively fine and well sorted.

Remarks. The synonymy given above departs from that suggested by Bergquist (1980b: 474) in including *Stelospongia flabellum*. Though Bergquist did not elaborate on this, the distinction, judging from the descriptions, and from my cursory, macroscopic examination of Carter's and Lendenfeld's specimens, relies only on external shape. That the flabellate habit may intergrade in some specimens,

with the columnar to subclavate habit of Lamarck's specimens is demonstrated by F52056, but even better by the specimens described by Whitelegge (1901, as *Stelospongia canalis*). The figured specimen, in particular, shows a main lamella and short peduncle very similar to the lectotype of *Stelospongia flabellum*, but, in addition, shorter secondary fronds attached vertically and partly folded, like in F52056. It should also be noted that two of the eight paralectotypes of *Stelospongia flabellum* (BMNH unregistered, dry) are of the *rimosa*-type.

The erroneous inclusion by Lendenfeld (1889b) of *Stelospongia flabelliformis* Carter as synonym of his *Stelospongia flabellum*, which confused Whitelegge (1901: 115), needs to be clarified. *Stelospongia flabelliformis* is a junior synonym of *Thorecta farlovi* (Hyatt, 1877) on the basis of five of the six syntypes (one wet) accepted by Wiedenmayer et al. (in press). Carter (1885c: 305) mentioned only three specimens in his description. In his *Manuscript Catalogue of Type Specimens from the J.B. Wilson Collection* (unpublished, BMNH; copy in NMV Sponge Archive), however, 7 dry specimens are listed under *Stelospongia flabelliformis*. All the specimens in Carter's Catalogue are registered (BMNH 1886.12.15.1–508). Apart from inconsistencies in numbers of types and their preservation, also in other species, there are occasional inconsistencies between published names, names on Carter's autograph labels, and entries in the BMNH Register. This may be partly due to negligence by Carter, associated with piecemeal publication of rather hastily written descriptions, and, as with Lendenfeld, changes of names on this occasion, without corresponding corrections on labels. But many such discrepancies may have been deliberate: some of Carter's labels bear, after the species name, page references to publications, while others do not. I suspect, therefore, that Carter, in the case of larger type series, indicated in descriptions only the number of those specimens examined with more care (microscopically). Under "Obs.", Carter (1885c: 305) mentioned in passing the similarity of his specimens with the photograph of *Spongelia farlovi* in Hyatt (1877, pl. 17 fig. 14). This photograph I judge sufficient to identify *S. flabelliformis* with it, together with the specimens correctly identified as *Thorecta farlovi* by Lendenfeld (1889b, especially pl. 23 fig. 7, refigured by Bergquist, 1980b, fig. 12d, with the erroneous caption *Taonura flabelliformis*). The lectotype of *Stelospongia flabellum* (Bergquist, 1980b, fig. 14a) is the only specimen of Carter/Wilson in Lendenfeld's type series. It is labelled by Carter "*?Spongelia Farlovii* Hyatt p. 536, pl. xvii fig. 14, Australia." It can therefore be surmised that this is one of the

seven dry syntypes of *Stelospongia flabelliformis* in Carter's Manuscript Catalogue, and that Lendenfeld (1889b) was for the least part right in including *S. flabelliformis* as synonym of *S. flabellum*.

Dysideidae Gray, 1867

Dysidea Johnston

Dysidea Johnston, 1842: 251. — Burton, 1934a: 582 (synonymy with nomina vana and nomina nulla; definition, discussion, revision of type species). — Vacelet, 1959: 66 (synonymy, definition, discussion, revision of Mediterranean species). — Bergquist, 1965: 142 (discussion). — Wiedenmayer, 1977a: 72 (synonymy with further references, definition, discussion of West-Indian species). — Van Soest, 1978: 51 (definition, discussion, revision of West-Indian species). — Bergquist, 1980b: 480 (synonymy in part; not *Sarcocornea*; definition, discussion, revision).

Spongelia Nardo, 1847a: 115 (nomen nudum). — Schmidt, 1862: 28. — Wiedenmayer, 1977a: 72 (further references).

Aulena Lendenfeld, 1885f: 308 (part: *A. villosa* and *A. flabellum*; not *A. nigra*, a *Hippospongia*). — de Laubenfels, 1948: 33 (part: *A. villosa* only).

nec *Aulena* sensu Lendenfeld, 1889b: 90 (= *Echinoclathria*).

Halmopsis Lendenfeld, 1885f: 320. — Bergquist, 1980b: 454, 480 (as synonym of *Dysidea*).

Haastia Lendenfeld, 1888: 204. — Bergquist, 1980b: 482 (discussion, synonym of *Dysidea*).

Diagnosis. "Dysideidae in which all fibres are filled with detritus." (Bergquist, 1980b: 472.)

Dysidea avara (Schmidt)

Plate 16 figure 9, plate 35 figure 6,

text-figures 93–95

Selected synonymy.

Spongelia avara Schmidt, 1862: 29, pl. 3 fig. 6 (Zadar and Sibenik, Yugoslavia). — Schulze, 1878b: 127, pl. 6 figs 1, 4; pl. 8 figs 1–7, 13–14 (anatomy) (Hvar Island, Yugoslavia). — Lendenfeld, 1889b: 667, pl. 43 figs 3–4, 6 (Port Phillip Heads, Vic.).

Dysidea avara. — de Laubenfels, 1948: 142 (part: résumé, discussion), pl. 23 fig. 43 (specimen from Philippines described in 1935 as *D. pallescens*). — de Laubenfels, 1950a: 9 (Hawaii). — de Laubenfels, 1954a: 36, text-fig. 18 (Micronesia). — Vacelet, 1959: 68, pl. 1 fig. 7 (description, discussion, notes on ecology; off Marseille). — Rützler, 1965: 42 (further references, description, ecology, distribution; Northern Adriatic Sea). — Boury-Esnault, 1971: 337 (notes on ecology, reproduction, further references; western Mediterranean). — Boury-Esnault, 1973a: 288 (Brazil, S of Porto Alegre). — Pulitzer-Finali and Pronzato, 1977: 87 (Bay of Naples, locality data only). — Pulitzer-Finali and Pronzato, 1980: 131 (western Mediterranean, locality data, remarks). — Rubió et al., 1981: 12, text-fig. 2 (description, distribution, ecology).

Spongelia pallescens Schmidt, 1862: 30, pl. 3 fig. 8 (Sibenik, Yugoslavia; lectotype described and figured by Burton, 1934a, see below). — Schmidt, 1864: 28 (part?, merged with *S. incrustans*, which was regarded as a good species by Vacelet, 1959, and Pulitzer-Finali and Pronzato, 1977, 1980). — Burton, 1934a: 591 (part, as synonym of *Dysidea fragilis*; BMNH 1867.7.26.9 designated lectotype [as holotype], described and figured text-fig. 30, pl. 2 fig. 4, pl. 2 fig. 3, Naples).

nec *Spongelia pallescens*. — Schulze, 1878b: 138, pl. 5 figs 1–4; pl. 6 figs 2–3, 5–7 (with sspp. *fragilis*, *elastica* and varr.; fide Vacelet, 1959: 67). — Polejaeff, 1884b: 42, pl. 3 fig. 1 (Bahia).

Dysidea pallescens. — de Laubenfels, 1935: 327 (figured in de Laubenfels, 1948; Puerto Galera, Mindoro, Philippines). — Boury-Esnault, 1971: 338.

Dysidea avara var. *pallescens*. — Vacelet, 1959: 69 (Gulf of Marseille). — Rützler, 1965: 42 (synonymy, description, ecology).

Material examined. Station KG 4, one specimen (F52057); station KG 6, one specimen (F52058).

Diagnosis. Commonly small, irregularly lobate, sprawling, occasionally digitate. In life, mauve, often mixed with grey, or dark purple. In alcohol, violet, brownish or beige. Softly spongy, limp, mostly easily torn, some specimens more resistant. Surface coarsely conulose; conules 1–6 mm high, with similar, irregular spacing; tips may be blunt, pointed, irregular, composite, crested. Oscules small, irregularly scattered, often in depressions. Choanosome cavernous. Fibrous skeleton lax, irregular. Fibres irregular, may be compressed, fenestrate, commonly loaded with detritus, but with spongin still visible. Detritus also interstitial, but not in dermis, which contains a fairly conspicuous, whitish collagenous reticulum.

Description. Sprawling depressed lobes, indistinctly separated by sinuous incisions, bearing some moderately deep invaginations above. Whole surface coarsely conulose in life, now, after shrinkage and partial maceration, frilly, with contorted conules or lacinules connected by discontinuous ridges, like miniature cockscombs, which frequently intersect, forming irregular reticulation with deep, angular depressions. In life mauve on surface, paler on underside, with whitish ridges, dull beige internally; now faded to yellowish beige (10 YR 8–9/4). Softly spongy, limp, easily torn.

In F52057 (pl. 16 fig. 9, text-fig. 93) conules often clustered, with expanded and blunt, composite tips (0.3–1 mm wide) roughened by protruding sand grains. Individual conules 1–3 mm high, very irregularly spaced; width and depth of interstitial depressions about 1–5 mm. Relief of F52058 similar, but conules more slender, with fine, tapering tips. Round oscules, 0.5–1 mm wide, irregu-



93



94



95

Figures 93–95. *Dysidea avara*. F52057, details in reflected light, $\times 4.1$. Figure 93. View of well preserved portion of surface. Figure 94. Mostly macerated peripheral portion showing tendency of fibres to form fenestrated lamellae. Figure 95. Perpendicular section showing cavernous interior.

larly scattered at bottoms of invaginations and in some of shallower depressions between conules. Very fine ostia barely visible between vague white nervures of ectosome in depressions.

Choanosome coarsely and thoroughly cavernous (text-fig. 95), with many round canals 2–3 mm wide, interstices sometimes as narrow as 200 μm . Matrix dense, yellowish-brown in transmitted light, with elongate, frequently somewhat contorted, sac-shaped choanocyte chambers often crowded and aligned.

Fibrous skeleton in F52057 lax and very irregular. Fibres 100–500 μm thick, commonly almost packed with mixed and ill-sorted detritus. Sand

grains attain 0.5 mm in size. Most fibres have irregularly knotty contours, and many thinner fibres abruptly expand to 2–4 times their diameter. Peripheral stratification of pale spongin enveloping grains frequently visible. A portion of fibre 700 μm long, tapering from 180 to 90 μm , free of detritus, with layered bark and thick pith (140–60 μm) transversely wrinkled. In F52057, fibres often form tight fascicles and fenestrate sheets, up to 1.3 mm wide (text-fig. 94). Much detritus also interstitially, scattered and clustered.

In F52058, thin fibres commonly 60 μm thick. Mixed detritus in all fibres generally finer and better sorted than in F52057, but larger lithic or skeletal

grains occur interstitially. Reticulation more regular than in F52057, without fascicles and fenestrate sheets.

Remarks. Vacelet (1959) and Rützler (1965) distinguished a typical variety, with coarser conules and deeper purple conserved in alcohol, from a var. *pallescens* with slightly finer conules (see pl. 2 figs 3, 4, in Burton, 1934a), thinner ectosome and a lighter purple streaked with white, which disappears in alcohol. Rützler also found that the choanocyte chambers in var. *pallescens* approximate the spherical type. Boury-Esnault (1971: 338) regarded *D. pallescens* as a good species. The new specimens, with size and density of conules as in the lectotype of *Spongelia pallescens*, corresponds with var. *pallescens* sensu Vacelet also in other external traits. But the almost spherical shape of choanocyte chambers is not developed. It remains to be seen whether the equivalent of the typical variety also occurs in Australian waters.

Order Dendroceratida Minchin, 1900

Darwinellidae Merejkowsky, 1879

Synonym: *Aplysillidae* Lendenfeld, 1883.

Aplysilla Schulze

Aplysilla Schulze, 1878a: 404. — Lendenfeld, 1889b: 698 (part). — Topsent, 1905a: CXC (definition in Darwinellidae, designation of *A. rosea* (Barrois) as type species. — de Laubenfels, 1936a: 32 (invalid designation of type species). — de Laubenfels, 1948: 163 (part; wrong type species). — Vacelet, 1959: 62 (definition, discussion, revision, wrong type species, *A. rosea* and *A. glacialis* merged in *A. sulfurea*). — Van Soest, 1978: 80 (West Indian records, discussion). — Bergquist, 1980b: 484 (definition, discussion, revision; *A. rosea*, *A. sulfurea* and *A. glacialis* as distinct species).

Simplicella Merejkowsky, 1878: 259. — Bergquist, 1980b: 484 (as synonym of *Aplysilla*).

Diagnosis. "[Darwinellidae] in which the sponge body is always encrusting and the fibres are always clear of detritus and almost unbranched." (Bergquist, 1980b: 484.)

Aplysilla rosea (Barrois)

Plate 16 figure 8

Selected synonymy.

Verongia rosea Barrois, 1876: 57 (Roscoff, English Channel). — de Laubenfels, 1948: 167 (as synonym of *Aplysilla glacialis*).

Aplysilla rosea Schulze, 1878a: 416 (Trieste, Adriatic Sea). — ?Lendenfeld, 1888: 26 (part: nec *Aplysina cruor*, nec *A. naevus*; Sydney Harbour, 1 hypotype with slide in East Berlin, ZMB 2306). — ?Lendenfeld, 1889b: 708, pl. 44 fig. 2 (old record). — ?Whitelegge, 1889: 180 (off

Balls Head, Sydney Harbour, probably Lendenfeld's record). — ?Burton, 1930a: 510, pl. 2 fig. 3 (synonymy in part: nec *Aplysina naevus*, nec *A. cruor*). — ?Burton, 1934a: 595 (record only, Great Barrier Reef). — ?Burton, 1936a: 142 (record only; Oude Kraal, Muizenberg, South Africa). — Bergquist, 1967: 161 (Hawaii). — Lévi, 1952: 37 (West Africa). — Borojević et al., 1968: 29 (*A. sulfurea* merged, local distribution, ecology, further references; Roscoff). — Pulitzer-Finali and Pronzato, 1977: 98 (local distribution, *A. sulfurea* merged, discussion of colour, nomenclature; Bay of Naples). — Pulitzer-Finali and Pronzato, 1980: 152 (Ligurian Sea).

?*Aplysilla sulfurea* Schulze, 1978a: 405, pl. 23 figs 15, 18, 20–27; pl. 24 figs 28–30 (Adriatic). — de Laubenfels 1948: 163 (résumé, further reference). — Lévi, 1952: 37 (West Africa). — de Laubenfels, 1954a: 47 text-fig. 26 (Micronesia). — Vacelet, 1959: 62, pl. 1 figs 1, 2; (with *A. rosea* and *A. glacialis* as synonyms, priority disregarded; discussion of colour; description, ecology, further references). — Rützler, 1965: 41 (description, ecology, further references). — Bergquist, 1967: 162 (Hawaii). — Boury-Esnault, 1971: 333 (purple specimens included; local distribution, ecology, further references). — Vacelet and Vasseur, 1971: 115 (Tulear Reefs, Madagascar). — Vacelet et al., 1976: 107 (Tulear Reefs). — Van Soest, 1978: 80 (references to West Indian records).

?*Aplysilla sulphurea*. — Lendenfeld, 1889b: 707 (Sydney Harbour). — Thiele, 1905: 488, figs 112, 114 (Strait of Magellan). — Koltun, 1964: 111 (1966a: 112) (further references, diagnosis). — Bergquist, 1980b: 484, figs 2d, 20c, d (in review). — Rubiö et al., 1981: 40, text-fig. 12 (table of distribution, ecology, further references, western Mediterranean). — Boury-Esnault and van Beveren, 1982: 120 (part: encrusting specimen only, not pl. 20 fig. 78 — *Dendrilla antarctica* Topsent; Kerguelen).

?*Dysideopsis sulphurea* Lendenfeld, 1888: 156 (Sydney Harbour, NSW). — Whitelegge, 1889: 184 (off Shark Island, Sydney Harbour, probably Lendenfeld's record). — Bergquist, 1980b: 464 (in review, as synonym of *Aplysilla sulfurea*).

Material examined. Station KG 4, one specimen (F52061).

Diagnosis. Encrusting, 2–6 mm thick, commonly small, but may cover large areas. Limp, easily torn. In life pink, (bright or pale yellow?), occasionally dark purple; chiefly dull red or brownish in alcohol. Surface commonly conulose or bristly, rarely smooth or wrinkled, chiefly lipostomous. Choanosome dense, fleshy. Fibres mostly single, up to 6 mm high, with basal plate, pith with timble-shaped accretions, longitudinally striate bark; generally tapering to point in conule axis or above surface, occasionally simply branched.

Description. Crust, 2–4 mm thick, with angular outline, 1.5–2 × 3.5 cm wide, deep lateral incision in middle. Pink in life (values not recorded), now deep red-brown (10 R 4/6–8) with few paler spots (10 R 6/6). Limp, easily torn. White nudibranch

with elongate orange dots grazing on specimen before collecting.

Surface rough in one half, irregularly conulose to bristly. Other half rugose with a large smooth area. Isolated dendritic fibres mostly upright in rough half, tips protruding from surface here and there. In other half most of fibres uprooted, with basal discs partly protruding, branches recumbent at or just below upper surface. Corresponding conspicuous difference in conformation of lower surface: (1) Lacunose below rough upper surface, with about half of surface flush, with open canals, adhering to substrate in life; few fibres recumbent, particularly in glabrous depressions. (2) Undulating, with glabrous surface, fibres all uprooted and recumbent, except small area with large basal spongin plate supporting 2–3 fibres, slightly tilted.

Upper surface mostly glabrous, lipostomous, contains scattered and clustered sand grains at or just below surface.

Fibres conform to descriptions and figures in literature. Most fibres isolated, including basal plate, straggling to angular, branched once or twice. Single basal plates about 2–3 mm wide. Fibres 350–400 μ m thick proximally, longitudinally striate on outside, with pith third to half of diameter, showing characteristic convex accretionary interruptions. Fibres taper almost to point, with bark almost disappearing, commonly reaching length of 7 mm.

Remarks. Bergquist (1980b: 484), in keeping *A. sulfurea* and *A. rosea* distinct, cited only Vacelet (1959) as disagreeing with her on this point. Her statement: "It appears that colour is a stable specific character in this family, and variation from rose to yellow would not occur" stands isolated, and she does not elaborate on other taxonomic characters.

Other workers (French, Italian, and Spanish authors on Mediterranean and Atlantic records) have followed Vacelet (1959) in merging the two species in question. According to Pulitzer-Finali and Pronzato (1977: 98) only Descatoire (1969) has subsequently kept the two species distinct, besides Bergquist (1967). Of the other workers (Lévi, Vacelet, Boury-Esnault, Sarà, Pulitzer-Finali), none has apparently found other differences, besides colour, as in anatomy, ecology, or reproduction, in sympatric populations of the pink and yellow form. Of some interest, in this context, is that Pronzato (1975: 7, 10, 12), in discussing the taxonomic value of colour in *Aplysilla* and *Darwinella*, noted the presence in the Mediterranean, of the bluish purple phenotype of *Darwinella australiensis* (see also Pulitzer-Finali, 1977: 99; Pulitzer-Finali and Pronzato, 1980: 153). Another point is my observation

of the extremely variable colour of *Pseudoceratina crassa* in life (Wiedenmayer, 1977a: 75, as *Aiolochroia*), though this affects only the ectosome, and the genus is now placed in the order Verongida.

Darwinella Müller

[*Darwinia*] Schultze, 1865: 7 (nec *Darwinia* Bate, 1857).

Darwinella Müller, 1865: 344 (nomen novum for *Darwinia* Schultze).—Lendenfeld, 1889b: 673 (2 species included).—Dendy, 1905: 203 (definition, discussion).—Topsent, 1905a: CLXXIII (résumé for family, review of genus with descriptions of 9 species, 4 of which are new).—de Laubenfels, 1948: 168 (part: *D. muelleri* only, with excessive synonymy).—Lévi, 1952: 38 (brief review with key).—Vacelet, 1959: 63 (résumé of Lévi, 1952, for Mediterranean records).—Bergquist, 1961c: 207 (discussion, new species).—Pronzato, 1975: 5 (résumé, review and revision, with reproductions of original figures, notes on distribution with map, key).—Van Soest, 1978: 79 (résumé, discussion of West Indian records).—Bergquist 1980b: 486 (synonymy, definition, discussion, revision on the basis of Lendenfeld, 1889b, only).

Diagnosis. "[Darwinellidae] in which the slightly ramified dendritic fibre skeleton is supplemented by diactinal, triactinal, or quadriactinal spongin spicules. There is no sand in the fibres. The sponges are encrusting or massive to lobate and [commonly] small." (Bergquist, 1980b: 486.)

Darwinella australiensis Carter

Plate 16 figure 12, plate 17 figures 1, 2,
plate 36 figure 1

Darwinella australiensis Carter, 1885b: 202 (Port Phillip Heads, Vic.).—Lendenfeld, 1885a: 22.—Lendenfeld, 1889b: 679, pl. 46 figs 1–5, 11 (redescription of holotype).—Topsent, 1905a: CLXXVI (résumé, old record).—Henschel, 1912: 429 (Aru Islands, Arafura Sea, Indonesia).—Dendy, 1916b: 139 (Okhamandal, India).—Lévi, 1952: 38, fig. 1 (synonymy, description, discussion; Senegal).—Pronzato, 1975: 8f., 16, text-figs. 2, 7(2), 8 (synonymy here expanded, résumés, discussion, distribution; note on colour variants, horny spicules; Ligurian Sea and Gulf of Naples).—Pulitzer-Finali and Pronzato, 1977: 99 (notes on horny spicules, colour variants).—Pulitzer-Finali and Pronzato, 1980: 153 (remark on colour variants).—Rubió et al., 1981: 43, text-figs 13, 14 (description, distribution and ecology).

Darwinella simplex Topsent, 1892c: xxvii (Mediterranean coast of France).—Topsent, 1904: 55, pl. 9 fig. 3 (Azores).—Topsent, 1905a: CLXXVI (résumé, discussion).—Dendy, 1905: 204, pl. 15 figs 1, 2 (Sri Lanka).—Burton, 1959: 268 (synonymy, record only; south coast of Arabia).

Darwinella intermedia Topsent, 1894b: xxxvii (Banyuls, Mediterranean coast of France).—Topsent, 1905a: CLXXVII, fig. 1 (résumé).—Borojević et al., 1968: 29

(near Roscoff, English Channel). — Pronzato, 1975: 12, 16, 18 (résumés, synonymy, distribution, key).

Darwinella duplex Topsent, 1905a: CLXXIX (replacement name for *Darwinella simplex*: Topsent, 1904).

Darwinella rosacea Hechtel, 1965: 17 (Jamaica).

Darwinella viscosa Boury-Esnault, 1971: 334, pls 6, 7 (Mediterranean coast of France).

Darwinella muelleri. — de Laubenfels, 1950b: 38, text-fig. 16 (nec Schultz; Bermudas).

Material examined. Station BSS 180, one specimen (F52062); station BSS 181, two specimens (F52063, F52064). Type specimens of *Darwinella australiensis* (BMNH).

Diagnosis. Thickly encrusting, cushion-shaped, or irregularly compressed-lobate, digitate, tongue-shaped. Surface coarsely conulose, conules angular, compressed, pyramidal, often connected by ridges. Soft, limp, easily torn, more or less viscid. Colour in life variable: brownish orange, deep red, bluish-violet, purple, pink, yellow, orange. Oscules 1–4 mm wide, mostly apical and marginal, but also on flanks and in depressions. Ectosome diaphanous, with regular collagenous reticulum. Fibres pink, mostly isolated, basally expanded, short and sparsely branched in encrusting specimens, similar to those in *Aplysilla*; longer, more prolifically dendritic in lobate specimens. Horny spicules of variable abundance, tend to be segregated by size and individuals: commonly pink, with crooked rays when large, pale and regular when small, most frequently triactinal, less often tetractinal, rarely pentactinal and diactinal.

Description. F52062 basally attached to fragment of shell, compressed-clavate, expanding from width of 7 mm proximally, to tongue shaped end 18 mm wide and 4 mm thick. Length of specimen 5.5 cm.

Other specimens (pl. 16 fig. 12, pl. 17 fig. 1) more massive, with clustering, angular, more or less compressed lobes separated by deep, narrow depressions or invaginations. F52063, $2 \times 2.5 \times 6$ cm; F52064, $1-2.5 \times 2-3 \times 4$ cm. Base of attachment small, on narrowest side on both specimens.

Brownish orange in life, lighter and duller in F52062 (5 YR 6/8), deeper in other two (2.5 YR 5/10). Colour now faded to drab, more so in F52062 (7.5 YR 7–8/4) than in other two (2.5 YR 6/4 to 5 YR 7/4). Soft, limp, slightly viscid. Some clear mucus emitted after collecting.

Most of surface irregularly conulose; conules compressed to pyramidal, occasionally bifid or clustering, contorted, connected by coarser or finer ridges of variable relief. Ridges often aligned across several conules, sparingly branched and anastomosed, forming incomplete rugoreticulation. Pattern coarser and most pronounced

in F52063, comparatively subdued in F52062. Spacing of conules mostly 2–7 mm, but some larger smooth interstices occur, particularly in depressions between lobes.

Oscules 1–4 mm wide, situated mostly on top and on edges of lobes, also on sides, in depressions between conules, some hidden and almost closed. Surface in depressions regularly dotted by mouths of inhalant canals, around 1 mm wide, spaced 2–5 mm, clearly visible through ectosome. Ectosome contains regular reticulum of collagen fibres, barely visible with unaided eye, distinct at low magnification; its meshes square to polygonal in centre of depressions, 200–300 μ m wide, elongate, with radial nervures around conule tips. 4 to 10 ostia to each mesh.

From fracture in F52064, a fibre protrudes for 15 mm, regularly branched and tapering, branching points 3 to 5 mm apart. Abundant corneous spicules of this specimen pink in reflected light.

Ectosome 45–200 μ m thick, frequently stratified, with two or three layers: (1) Outer, evenly granular layer, with radial or oblique ostia mostly conspicuous; (2) inner, tangentially fibrillate layer with indistinct radial ostia; and (3) discontinuous layer of crypts. Stratification and third layer most distinct in F52062, ectosome thus detachable between conules. In other two, stratification may be indistinct or obscured by interfingering of layers, and crypts may occupy part of fibrillous layer. In F52064, ectosome contains mulberry-shaped microsymbionts, 17–25 μ m in diameter, mostly packed in outer layer, crowded to scattered below, also in peripheral choanosome. "Fibrils" of second layer possibly filamentous microsymbionts.

Choanosome stringy, with subparallel wavy canals, and elongate, crowded to packed choanocyte chambers aligned inbetween. Choanosome contains much detritus in F52063, few foreign inclusions in other two. F52064 contains ova, 72–208 μ m in diameter, surrounded by thick layer of follicle cells.

Fibres comprise typical stratified bark and straggling knotty pith with timble-shaped accretion lines. Fibre diameters commonly 132–272 μ m below outermost divisions, rarely reaching 373 μ m. Pith diameters commonly around 20% of thicker fibres, 40% of thinner ones. Regularly spaced elongate cells or pits occasionally seen on surface of pith. Junctions of branches either "grafted", or continuous, with confluent pith (cf. Boury-Esnault, 1971: 335).

Horny spicules rare, pale and small in F52062 and F52063, with mostly equal, straight and pointed rays in one plane, 96–108–118 \times 10–13 μ m in F52062, 72–83–97 \times 9–12 μ m in F52063. Horny

spicules in F52064 much more conspicuous (pl. 36 fig. 1), all larger, mostly red-brown in transmitted light (two very pale), about as frequent as in diagrammatic figure in Lendenfeld (1889b, pl. 46 fig. 2), but rays rarely straight, commonly bent, curved or flexuous, with thin pith of variable distinctness. In six sections examined, 62 complete spicules were observed: 34 triactines, 27 tetractines, one pentactine. Of former, some have atrophied fourth ray not exceeding its thickness in length. Rays $187 \times 19 \mu\text{m}$ to $1347 \times 40 \mu\text{m}$. A single pale, unequal smaller triactine, longest ray $93 \times 7 \mu\text{m}$, may be foreign.

Remarks. Contrary to Lévi's (1952) and Pronzato's (1975) opinions, *Darwinella intermedia* is here merged in *D. australiensis*. I could not detect any significant difference in structure of ectosome, choanosome and fibres in the new specimens, of which the last two (with identical colour) came from the same collecting station. Topsent (1894b) described *D. intermedia* as golden yellow in life with small triactines having flexuous rays $100\text{--}150 \mu\text{m}$ long ($67\text{--}165 \mu\text{m}$ in fig. 1 in Topsent, 1905a), $12\text{--}13 \mu\text{m}$ thick at the base. *Darwinella rosacea*, merged in *D. intermedia* by Pronzato (1975: 12), was described by Hechtel (1965: 17) as pink in life, pinkish brown or beige in alcohol, with spicule rays measuring $130\text{--}276 \times 10\text{--}17 \mu\text{m}$. "Venetian Red", the colour indicated by Carter (1885b: 202) for the living *D. australiensis*, probably means brownish vermilion (10 R 5-6/8-10), while that in alcohol is given as "dark grey flesh". Dendy (1905: 204) indicated dark purple in alcohol for his specimen of *D. simplex*. *D. viscosa* was orange in life (Boury-Esnault, 1971: 334). Pronzato (1975: 10, 12) gave dark red, violet, and light bluish purple as colour variants in life for specimens of *D. australiensis* in the Mediterranean. Rubió et al. (1981: 46) described the colour of *D. australiensis* as a strong pink in life. The spicules in their material are pink, comparatively small triactines (exclusively), with rays measuring $200\text{--}750 \times 14\text{--}32 \mu\text{m}$. Segregation of spicules by categories within specimens was reported by Topsent (1905a: CLXXIX, for *D. duplex*), Lévi (1952: 38, for *D. australiensis*), and Boury-Esnault (1971: 334, for *D. viscosa*).

Few indications are found in the literature concerning the relative frequency of spicules. Contrasting with the high frequency in Lendenfeld's figure (1889b, pl. 46 fig. 2, based on Carter's material) and in F52064 are Dendy's statements (1905: 204; 1916b: 139) as to the rather scarce occurrence of spicules in his specimens. Exclusive occurrence of triactines was recorded for *D. intermedia* and *D. rosacea*, but also for some other records in the

above synonymy. For the remaining records, variable proportions of diactines and tetractines were indicated.

It should be noted that there is some overlap, albeit small, in spicule dimensions (length of rays) between the specimens of Hechtel (1965), of Rubió et al. (1981), and F52064. Nevertheless, there is obviously a strong tendency in this species, as here conceived, for spicules to be segregated by sizes in different specimens. The significance of this is not understood at present, since, as noted in two of the new specimens, it may occur in strictly sympatric populations. This might be taken as ruling out both biogeographical and ecological (niche) segregation. But cohabitation of sibling species or subspecies in our area does not preclude spatial isolation of the same in other regions, or (particularly for southern Australia with its complex and poorly understood biogeographical history and position) in the past.

The latter point should be viewed in perspective of temporary disjunction (in geological terms, i.e. through palaeogeographical evolution) of demes or clines, and secondary sympatric reunion with or without effect on the panmictic balance, and the difficulties in justifying subspecies in sponges (see review in Wiedenmayer, 1974).

Considering that most descriptions of records of this species complex outside the Mediterranean are based on single specimens, it seems preferable, at present, not to distinguish a nominotypical subspecies from a ssp. *intermedia*.

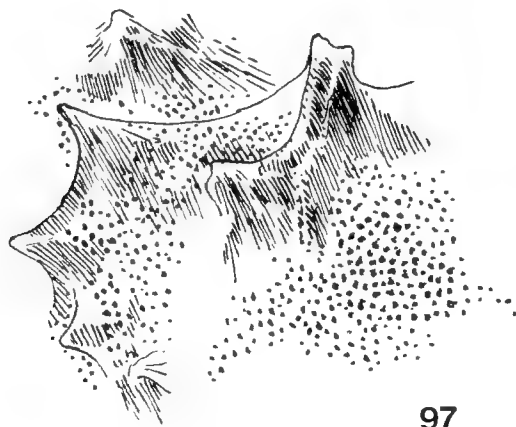
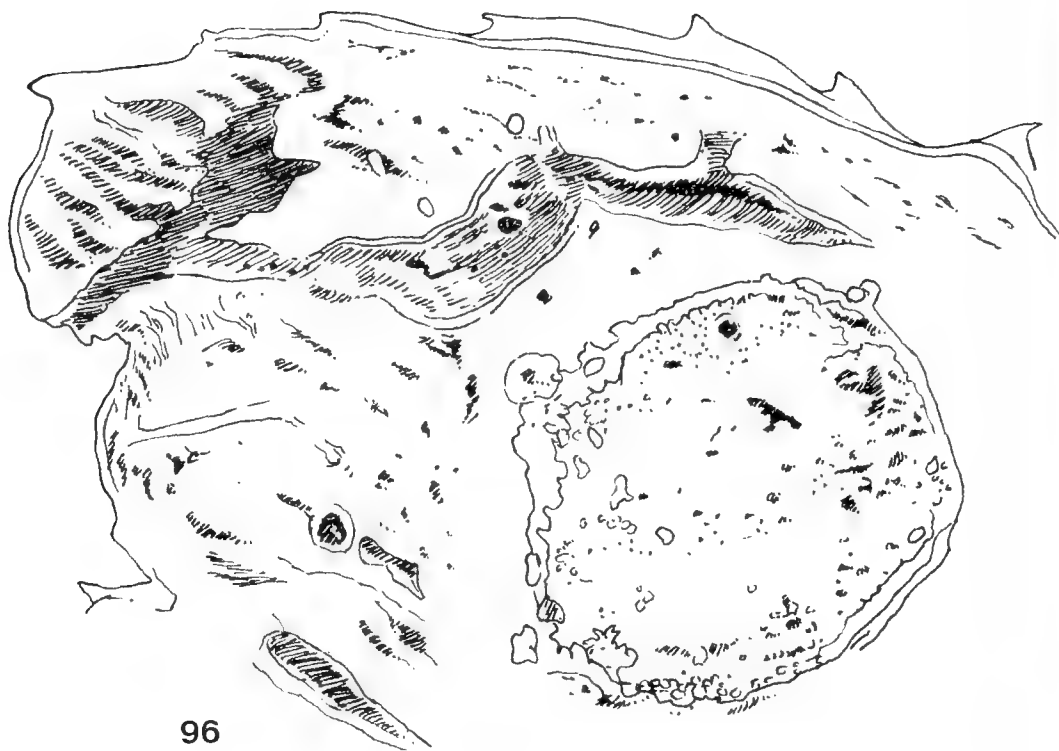
Darwinella gardineri Topsent

Plate 17 figures 3, 7, text-figures 96, 97

Darwinella gardineri Topsent, 1905a: CLXXIX (Fadifolu Atoll, Maldive Islands, Indian Ocean). — Lévi, 1958: 42 (Abulat Island, Red Sea). — Pronzato, 1975: 13 (résumé), 16 (distribution), 18 (in key), figs 5 (spicules), 9 (in situ, colour, Ligurian Sea, new record). — Pulitzer-Finali and Pronzato, 1980: 152 (brief description including colour; Ligurian Sea).

Material examined. Station KG 4, one specimen (F52065); station KG 7, one specimen (52066).

Diagnosis. Encrusting to irregularly angular-lobate, or lacunose-clathrate. Softly to firmly rubbery, slightly viscid; deep yellow in life, with dark red-brown fibres, turning dark olivaceous, then purplish black after collecting and preservation. Oscules commonly as contorted slits, chiefly marginal. Surface coarsely conulose, with conules compressed, more abundant on edges of lobes and lamellae, like cocks' combs; otherwise smooth to very finely wrinkled. Ectosome $100\text{--}200 \mu\text{m}$ thick, not detachable. Choanosome dense, with com-



Figures 96, 97. *Darwinella gardineri*. F52065, details in reflected light. Figure 96. Perpendicular section showing thickness of ectosome, canal system, and fully overgrown different sponge (lower right), $\times 8.2$. Figure 97. Portion of surface showing inhalant fields, $\times 6.6$.

canals, smaller ones often parallel (tiger-skin pattern in sections). Dendritic fibres more profusely branched below edges, tapering little, may be filled with filamentous algae. Horny spicules numerous, diactinal, smooth.

Description. F52065 (pl. 17 fig. 7, now dissected) angular, lobate, with thick, boxy lobe on one side, and compressed one, transversely folded, on opposite side; 1 to 1.8 cm in thickness, 6 cm in width, 1.5–2.5 cm in height. Some folds between lobes

deep, narrow invaginations. Small, multiple base of attachment.

Most of surface irregularly and coarsely conulose. Conules chiefly around tops of lobes, 1–2 mm high, mostly 2 mm apart, often contorted, connected by ridges. Some fibres protrude from conule tips. Some conules also on lower sides, where marginal dendritic fibres bulge below shrunken surface, with often wide, smooth depressions between ascending ridges. Along edge of thinner lobe, several fibres exposed, already upon collecting.

F52066 (pl. 17 fig. 3) lacunose, clathrate aggregation of contorted lamellae, with angular outline, 3.5 cm high, 6 × 8 cm wide. Lamellae mostly 2–4 mm thick; lacunae between them, open below and above, some marginal ones also on sides, 0.5–1.5 cm wide.

Surface generally more coarsely conulose than in F52065, with conules up to 5 mm high; many aligned on outside and edges of lamellae, like clustering cockscombs. Inner sides of lamellae (walls of lacunae) mostly smooth, with few conules. Base of attachment small and multiple, some fibres partly free, many protruding from conules.

F52065 has completely overgrown small pinkish drab sponge with sandy ectosome (text-fig. 96). Similar, if not conspecific sponge attached to one side of F52066. In life, sulfur-yellow in F52065, golden yellow (10 YR to 2.5 Y 8/10) in F52066. Soon after collecting change to dark olivaceous, purplish black (5 R 2/2) in alcohol, choanosome slightly lighter in F52065 (5 R 3/4–4). Fibres very conspicuous in life, dark red-brown, visible also just below ectosome, colour preserved in alcohol. Now compressible, slightly limp in F52065, firmer, almost leathery in F52066, slightly viscid.

Oscules more conspicuous on F52065, contorted slits up to 5 mm long and 0.5–1 mm wide, mostly on upper edges of lobes, some also laterally. With low magnification (10×), surface smooth to very finely striate or wrinkled in many areas; other areas, particularly between conules, bear discontinuous inhalant fields with sinuous outlines (text-fig. 97), occasionally connected by meandering bridges, with reticulation of slightly elevated collagenous bands, somewhat lighter than remaining surface in F52065. Bands about 100 µm wide outline rounded depressions of similar width pierced by ostia. Occasionally, radial pattern of bands converging on conule tips. Regularly pitted fields less distinct in F52066.

Ectosome 100–200 µm thick, generally not detachable. Choanosome dense, cheese-like, with tiger-striped pattern of subparallel inhalant canals (text-fig. 96). Terminal exhalant canals mostly compressed, section like outline of oscules.

Outer zone of ectosome about 30 µm thick, more deeply pigmented. Peripheral choanosome more deeply pigmented, often with palisade of parallel inhalant canals or vestibules, about 30 µm wide. Choanocyte chambers oval, 56–97 µm long.

Dendritic fibres more profusely branched just below apical oscules (edges of lamellae in F52066), occasionally with oblique anastomoses, by confluence of adjoining branches. Most fibres 200–270 µm thick, diameters at base up to 500 µm. Fibres taper little, diameters around 200 µm at 4–5 mm below conule tips common. Pith, with weak timble-shaped accretion lines, commonly 33% to 47% of fibre diameter, often almost clear, weakly granular. In F52066, filamentous algae common in bark and pith.

Choanosome contains numerous diactinal spicules in both specimens, some protruding from surface along edges of lamellae just above base of attachment, straight to slightly sinuous, occasionally bent, very pale, with faint contrast in Canada balsam, clear except for axial filament, tapering gradually and symmetrically to sharp points. Few entire ones isolated, 1550–1760 × 15–24 µm.

Remarks. Specimens of this species hitherto recorded were encrusting, with low, simple or sparsely branched fibres. The colour of Topsent's holotype in life is unknown, but is stated to be pink ("rose") in alcohol. Lévi (1958: 42) indicated vivid yellow, turning purple in alcohol. Pulitzer-Finali and Pronzato (1980: 153) gave the index C.C. 316 in Séguy (1936, *Code Universel des Couleurs*. Paris: Lechevalier), which is lemon yellow, equivalent to 7.5 Y 8–9/8–10 in Munsell. Spicule dimensions given by Topsent (1905a: CLXXX) are 1600–2000 × 20 µm (half as much for a few). Pronzato (1975: 14, fig. 5) indicated lengths of 804 to 1780 µm for diactines in his Mediterranean material.

The occurrence of massive-lobate specimens in this species is not surprising, given a similar range of shapes in *D. australiensis*. The lacunose-clathrate habit of F52066 is reminiscent of *Dendrilla lacunosa* Hentschel (1912: 431, pl. 15 fig. 3), the general shape of which, however, is terete-ramose, with a very strong axial fibre and thinner radial, branching fibres.

The presence of filamentous algae in the fibres recalls the similar occurrence in *Mycale* (*Arenochalina*) *mirabilis* described above. It is not unique in *Darwinella*, since Dendy (1905, 1916b) found a similar association (interpreted as "parasitic fungus?") in his material of *Dendrilla australiensis* (as *simplex* in 1905).

The endozoic sandy sponge recalls an analogous

association of "*Gellius*" and *Aplysilla* described by Rützler (1970: 94) from the Adriatic coast.

Dendrilla Lendenfeld

Dendrilla Lendenfeld, 1883: 270. — Lendenfeld, 1889b: 709 (part: *D. rosea* and *D. aerophoba* only). — Topsent, 1905a: CXC (subsequent designation of type species). — Hentschel, 1912: 430 f. (part: *D. lacunosa*, *D. mertoni* spp. nov.; not *D. lendenfeldi*, a *Dictyodendrilla*). — de Laubenfels, 1936a: 32 (invalid designation of type species). — de Laubenfels, 1948: 153 (part, wrong type species, wrong transfers). — Vacelet, 1958: 143–147 (résumé, definition, discussion, erroneous revision, new Mediterranean species). — Vacelet, 1959: 65 (definition, discussion, résumé of Mediterranean species). — Van Soest, 1978: 81 (discussion of possible West Indian records). — Bergquist, 1980b: 486 (definition, discussion, revision).

Diagnosis. "Large, erect, branching or complex lamellate [Darwinellidae] in which the fibres branch repeatedly but do not anastomose. The fibres contain no foreign coring material." (Bergquist, 1980b: 486.)

Dendrilla cactus (Selenka)

Text-figure 98

Spongelia cactus Selenka, 1867: 566, pl. 35 fig. 5 (Bass Strait).

Aplysilla cactus. — Schulze, 1878a: 417 (holotype re-examined, redescribed).

Dendrilla cactus. — de Laubenfels, 1948: 152 (part: not pl. 26 fig. 47; description composite, partly based on *Megalopastas retiaris* Dendy, a *Dictyodendrilla*).

nec *Dendrilla cactus*. — Bergquist, 1961c: 215, figs 5a, b.

Megalopastas cactus. — Vacelet, 1958: 144 (in revision, unrecognisable).

Dendrilla rosea Lendenfeld, 1883: 271, pl. 10 figs 3, 4; pl. 12 figs 16, 19–23; pl. 13 figs 24–27, 29–32 (Port

Phillip Bay, Vic.; Adelaide, SA). — Carter, 1886f: 288 (remarks on histology). — Dendy, 1890a: 79 (Port Phillip Bay). — Vacelet, 1958: 143, 144 (in review). — Koltun, 1971: 42 (Red Sea). — Coleman, 1977: 17 (in colour). — Bergquist, 1980b: 488, fig. 21a (in review). — Bergquist and Skinner, 1982: 49 (fig. 3.7), 54; pl. 1 fig. 3 (colour).

Dendrilla rosea var. *typica* Lendenfeld, 1888: 28 (nomen vanum for nominotypical subspecies; Sydney Harbour, NSW). — Lendenfeld, 1889b: 718, pl. 44 figs 4, 7, 11; pl. 45 figs 3, 4, 7, 9, 11 (old records). — Whitelegge, 1889: 180 (off Green Point, Sydney Harbour; probably Lendenfeld's records). — Hentschel, 1912: 430 (Aru Islands, Arafura Sea, Indonesia).

Luffaria digitata Carter, 1885b: 201 (Port Phillip Heads, Vic.).

Dendrilla rosea var. *digitata*. — Carter, 1886f: 281 (Westernport Bay, Vic.). — Lendenfeld, 1889b: 718, pl. 44 fig. 8, pl. 45 fig. 8 (old record).

Aplysilla rosea (sic, nec Barrois). — Rockman, 1974: 28f. (in colour, no locality).

Material examined. Station KG 2, one specimen (F52067); Station KG 7, two specimens (F52068, colour slide only; F52069, skeleton only).

Diagnosis. Massive, irregularly lobate to bushy and pedunculate, or branching, erect, with isodiametric branches. Light red to purplish pink in life, drab to pale orange and red-brown in alcohol. Soft, limp, firmer in branching specimens. Flesh tends to collapse and dissolve after collecting, fibre skeleton thus easily macerated. Surface coarsely and regularly conulose, with conules compressed-pyramidal, often complex, contorted, with tapering fibre tips protruding. Surface otherwise smooth, collagenous reticulum indistinct. Fibrous skeleton thoroughly dendritic, with basal plate, and very thick fibres in peduncle of bushy specimens and axis of ramose ones.

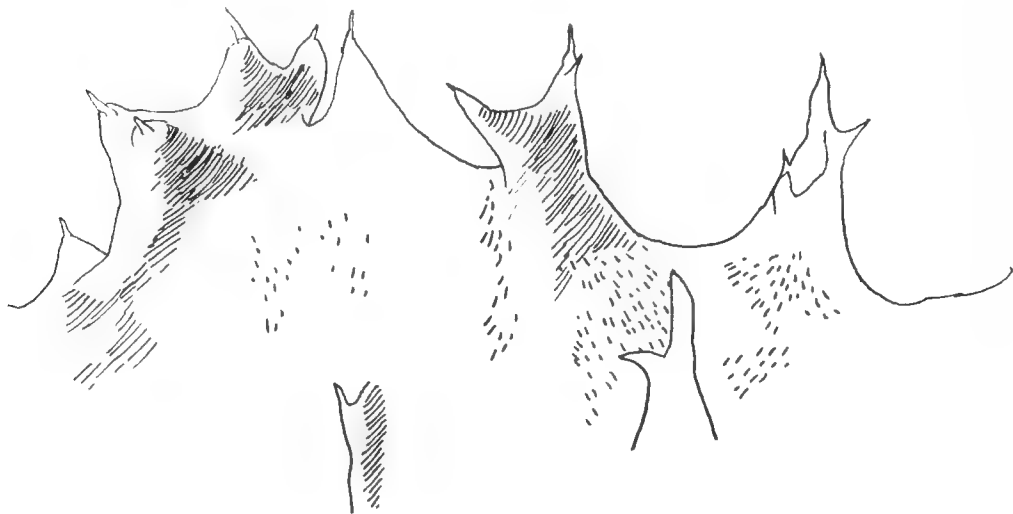


Figure 98. *Dendrilla cactus*. F52067, portion of surface showing inhalant fields with elongate ostia, $\times 6.6$.

Remarks. This is one of the most common and characteristic species of the southern Australian shelf fauna, and is likely to be illustrated in other popular books than the three referred to above. No complete redescription is therefore needed here.

According to my field notes, the first specimen, a bushy one, had a pure rosy pink colour in life (5 RP 8/8–10). The second specimen, decidedly ramose, was light red (5 R 7/10–12). The colour in alcohol of the first specimen is drab to pale orange in depressions (7.5 YR 6–7/2–8), red-brown around the conules (10 R 4–5/6–8).

The consistency is soft and limp, and the flesh has a pronounced tendency to collapse, shrink and dissolve into tatters in seawater soon after collecting. The fine dermal reticulation is not as clear as in the other darwinellids described above, and is usually better developed in irregular fields between conules, as in *Darwinella gardineri*. Here, the meshes with the cribripores are frequently elongated radially (text-fig. 98), possibly due to the shrinkage, which leaves many of the pale fibres bulging and partly denuded.

Whether single, continuous, thick axial fibres with short, much thinner lateral branches (as in pl. 45 fig. 8 in Lendenfeld, 1889b, 3–5 mm thick near the base) are consistently developed in teret-ramose specimens, and whether *digitata* is justified as a form or subspecies, must be left open to question for now. F52068 (unfortunately lost overboard soon after collecting) had this type of skeleton. I suspect that taxonomic distinction is not justified, because Hentschel (1912: 430) described a teret-ramose specimen having tight fascicles of fibres in the axes, and a transitional specimen (which he compared to pl. 44 fig. 7 in Lendenfeld, 1889b) had a similar structure.

Lendenfeld (1889b: 718) included *Spongelia cactus* Selenka in the synonymy of *Dendrilla rosea* var. *typica*, which, if accepted, has to replace *rosea* as its senior synonym. This synonymy is here accepted not because of Selenka's inadequate and misleading description (claiming that the skeletal structure is the same as in *Spongelia horrens*, i.e. reticulate), but because of the redescription of the holotype by Schulze (1878a: 417, cited by Lendenfeld, 1888: 28; 1889b: 718). This is sufficiently clear to establish the synonymy. The fibres are described as clear, dendritic, with the structure of those in *Aplysilla*. The interstitial choanosome is also said to be indistinguishable from that in *Aplysilla*. Schulze, five years before Lendenfeld established *Dendrilla*, included massive forms with dendritic fibres in *Aplysilla*, and cited, in the same context, massive specimens from the Adriatic, which today would probably be identified as either *Dendrilla cir-*

sioides or *D. acantha*, the only species presently known from the Mediterranean (see Pulitzer-Finali, 1983: 613).

Bergquist (1980b) recognised only one species (*rosea*) with Australian records in *Dendrilla*. *Dendrilla aerophoba* Lendenfeld (1883), which Bergquist (1980b: 488) regarded as unrecognisable, may or may not be a true *Dendrilla*, depending on whether the peculiar fibre structure (strong longitudinal folding of the bark) and the regularly armoured ectosome are regarded as sufficiently aberrant within *Dendrilla*. The strong colour change upon preservation (from brilliant yellow to dark blue or bluish black, reminiscent of *Darwinella gardineri*) is also distinctive. It can therefore be ruled out that what Selenka and Schulze described was *D. aerophoba*, and it is highly unlikely that they had before them a third species of *Dendrilla*, or a *Darwinella* in which they overlooked the spicules (Schulze mentioned examining a section).

Schulze had borrowed the holotype from the Zoological Institute in Göttingen (where Selenka worked in 1867). The Selenka collection is no longer there (teste Prof. P. Kuenzer, II. Zoologisches Institut und Museum der Universität, Göttingen, 1983), and nothing is known of its present whereabouts. The holotype of *Dendrilla aerophoba* Lendenfeld, however, is extant in East Berlin (ZMB 2254 with one slide; ZMB 10395, second slide).

Burton (1934a: 595) included *Spongelia cactus* and *Dendrilla rosea* in his highly composite synonymy of *Dendrilla membranosa* (Pallas). *Spongia membranosa* Pallas should be dropped as a nomen dubium. According to the original description it was whip-shaped, 3.5 feet tall, finger-thick, with a single branch. Whatever it was, it was not a *Dendrilla*. *Spongia membranosa*: Esper (*membranacea* in the caption of pl. 34 is an incorrect subsequent spelling) is an *Iotrochota*, as Topsent (1920c: 322) has shown. *Dendrilla membranosa* sensu auctorum is composite. Records from northern Australia (Ridley, 1884a: 398; Lendenfeld, 1889b: 715; Bergquist, 1980b: 488) belong to *Dictyodendrilla* and will receive a replacement name (Wiedenmayer et al., in press). Antarctic/Subantarctic records (Burton, 1929a: 448; Burton 1934b: 46; Burton, 1938: 19; Koltun, 1964: 111; Koltun, 1976: 197) belong to *Dendrilla antarctica*. Among the remaining entries in Burton's excessive synonymy are good species of *Dendrilla* and *Dictyodendrilla*. *Dendrilla cactus*: Bergquist (1961c: 215) is described as having a dendritic skeleton with occasional anastomoses; but in figure 5b anastomoses appear to be rather common, suggest-

ing that the specimen might belong to *Dictyodendrilla*. A special feature is the reinforcement of the ectosome by spicule fragments.

Order Verongiida Bergquist, 1978

Aplysinidae Hyatt, 1875

Aplysina Nardo

[*Aplysia*] Nardo, 1833, col. 519 (nec *Aplysia* Linné, 1767).

Aplysina Nardo, 1834, col. 714 (in part; nomen novum for *Aplysia* Nardo). — Wiedenmayer, 1977a: 63 (synonymy with further references, definition, discussion). — Van Soest, 1978: 55, 63 (definition, discussion, revision of West Indian species). — Bergquist, 1980b: 492 (synonymy, definition, discussion, revision).

[*Fistularia*] Bowerbank, 1844a: 39 (nec *Fistularia* Linné, 1758).

Verongia Bowerbank, 1845: 403. — Vacelet, 1959: 86 (definition, discussion, review of Mediterranean species).

Luffaria Duchassaing and Michelotti, 1864: 59.

nec *Luffaria* sensu Polejaeff, 1884b: 69. — Lendenfeld, 1889b: 382 (— *Luffariella* in part).

Diagnosis. "Aplysinidae characterised by possession of fibres of only one kind with no foreign detritus and having a thick pith component. The fibres form a regular reticulum with large hexagonal meshes and have no specialised surface arrangement. Most, if not all, species display a marked colour change at death or on exposure to air, quickly changing from the normal yellow or yellow-green through blue to dark brown or purple." (Bergquist, 1980b: 492.). Pedunculate species with a secondary reticulation of finer fibres are here provisionally included.

Aplysina ianthelliformis (Lendenfeld)

Plate 17 figure 10, plate 36 figure 2

Dendrilla ianthelliformis Lendenfeld, 1888: 29 (Sydney Harbour). — Lendenfeld, 1889b: 719 (old record).

Aplysina ianthelliformis. — Bergquist, 1980b: 488 (transfer in review).

Material examined. Station BSS 187, one specimen (F52070). Holotype of *Dendrilla ianthelliformis* (AM).

Diagnosis. Stalked, flabellate. Frond up to 2 cm thick. Leathery to firmly rubbery, peduncle hard. In life, red-brown on elevations, golden yellow in depressions; turning brownish to purplish black after collecting and preservation (choanosome then dark brown). Surface indistinctly conulose and rugose, with vague rugo-reticulation. Oscules inconspicuous, in marginal invaginations. Ostia in indistinct areoles. Fleshly ectosome about 0.5 mm thick, partly detachable over thin crypts. Choanosome dense. Fibre skeleton dense, tangled, with chiefly dendritic primaries and irregularly reticu-

late, partly loose secondary fibres. Fibre-reticulation much denser in peduncle.

Description. Broadly flabellate, more or less symmetrical, with stocky pedicel 3.5 cm long in front, 1.8 cm thick in middle, its base slightly jutting forward, torn at back. Flabellum now contorted, 17.5 cm wide, 11.5 cm high in middle, of variable thickness (0.5–2 cm). Lateral transition of pedicel into flabellum elegantly curved. Outline of flabellum sinuous to angular. Right side, near margin, thicker than left, consisting of several overlapping lobes compressed in plane of flabellum, in two to three tiers.

Pedicel and its arched transition into flabellum almost smooth, faintly and finely wrinkled longitudinally. Front of frond traversed by some ridges, mostly radial, 3–5 mm wide and deep, locally (lower middle) up to 15 mm deep. Most of surface rough, combination of low conules and wrinkles of variable profile, never forming distinct rugo-reticulation. Conules and wrinkles rarely exceed 1 mm in width and relief, with interstices commonly 1–5 mm wide. Depressed interstices smooth or very finely wrinkled. Back of frond with some larger smooth depressions. Margin commonly more decidedly conulose.

In life, red-brown on elevated parts, golden yellow in depressions. Rugo-reticulation much more regular and pronounced in life, accentuated by colour differences. Now brownish to purplish black, superficially dark brown in choanosome. Leathery to firmly rubbery, elastic along margin; peduncle hard.

Oscules inconspicuous, probably as deep invaginations extending from bottom of some folds between marginal lobes. Some round, sharp-rimmed pits about 1 cm wide on both faces of frond. With low magnification (8–15 \times) surface of ectosome frequently like elephant hide covered with metallic paint. Ostia occasionally visible as clustering faint papillae in sharply defined round fields, which may be slightly raised.

In ruptured or partly macerated spots, peculiar main skeleton visible in flabellum: tangled, often dense, with chiefly dendritic primary fibres, and irregular reticulation of distinctly thinner secondaries. In reflected light, all fibres externally brown, with much lighter pith shining through.

Fleshy ectosome 225–640 μ m thick, partly detachable, frequently covers extensive thin crypts. Straggling primary fibres have diameters 100–185 μ m, 63% to 86% pith, spaced around 800 μ m. Secondaries knotty, 14–50 μ m thick, pith variable (27%–48%). Anastomosis prevails, with irregular meshsizes, from equal to diameters of secondaries

to order of spacing of primaries. Occasional short fenestrate fascicles. Junctions with primaries "grafted", pith truncated by continuous surface (bark) of primaries. Many secondaries dendritic, some short and stubby.

Remarks. See next species.

***Aplysina lendenfeldi* Bergquist**

Plate 17 figures 4, 5, plate 36 figures 3–6,
plate 37 figure 1

Thorecta freija.—Lendenfeld, 1889b: 366 (part: paralectotypes from Wollongong and Broughton Island, NSW, in AM only; not figured lectotype from Torres Strait in BMNH; fide Bergquist, 1980b).

Aplysina lendenfeldi Bergquist, 1980b: 470, 488, fig. 22e (for misidentified paralectotypes of *Thorecta freija* and fresh material; new locality (localities?) not indicated).

Verongia sp.—Bergquist and Skinner, 1982, pl. 1 fig. 2 (colour, no locality).

Material examined. Station KG 5, one specimen (F52071); station KG 7, one specimen (F52072).

Diagnosis. Stalked, body commonly cigar-shaped, with apical plateau bearing single collared oscule; occasionally compound, concrescent. Light orange to dull yellow, with red and purplish tinges in life; in alcohol, brownish black externally, dark orange brown internally. Surface on sides, mostly including upper part of stalk, faintly to coarsely rugoreticulate, with more or less depressed meshes usually elongate axially; or areolate, with areoles depressed in life, flush or raised, shiny in alcohol. Ostia cribriporal in areoles and depressions. Ectosome fleshy, thicker (up to 600 μ m) and stratified on elevated areas. Regular chone-like inhalant canals below areoles, palisade-like above, converging in lower ectosome to join subdermal crypts. Choanosome dense around terete axial atrium. Primary fibres chiefly dendritic and longitudinal, with few anastomoses in deeper choanosome, but with numerous radial branches in periphery, ending below or within ectosome. Secondaries scarce, crooked, mostly as anastomoses between primaries, occasionally dendritic. Fibre-reticulation much denser in peduncle.

Description. F52071 smaller (pl. 17 fig. 4), a club bent in middle. Lower part (pedicel) 5 cm long, somewhat compressed, 6 \times 8 mm thick. Main body compressed in plane diagonal to that of pedicel, expands symmetrically to 3 cm above top of pedicel, reaching 14–22 mm in width; then bent at 30° and tapering slightly to truncate top, 8 \times 15 mm wide. Compression less pronounced in life.

Upon collecting, whole surface below apex, and over much of the pedicel, with regularly spaced pits,

about 1 mm deep, mostly elongate axially, 1–2 mm wide, 2–5 mm long, with tabulate interstices 1–2 mm wide. Depressions on pedicel reduced to slits. Relief now partly disappeared through shrinkage, leaving scar-like, shiny dots sharply set off from matte interstitial surface. Upper half of pedicel and base of body now show rugo-vermiculate to rugoreticulate pattern of peripheral fibres bulging through shrunken ectosome.

Single apical oscule 3 \times 6 mm wide in life, slightly recessed within truncate apex, with fleshy contractile membrane and slightly upturned lip.

F52072 much larger (pl. 17 fig. 5), also clavate, to cypressiform, straight in life, now bent above pedicel, like F52071. Pedicel torn off above its base, 9 cm long, 12 mm wide, terete, partly enveloped, in lower half, by compound ascidian. Main body 13 cm long, 4.5 \times 5 cm wide in middle, 1.5 \times 2.5 cm wide at truncate apex bearing central single oscule.

Upon collecting, lower half of body showed faint rugo-reticulation, accentuated by differences in colour, with meshes around 7 \times 20 mm wide, elongated axially. More isodictyal, fainter and tighter rugo-reticulation partly on the upper portion, with other parts weakly verrucose. Surface now generally smooth, except irregular, weak rugae and folds, dendritic along and diagonally across body. Some interstitial areas finely verrucose or granular. Fine rugo-reticulate pattern on upper half of pedicel, like in F52071.

F52071 upon collecting dull yellow with purplish tinges. F52072 basically light orange (2.5 YR 7/10) with light red ridges on lower body (5 R 7/10) and some purplish drab in depressions (2.5 R 7/4). Surface now brownish black (5 R 2.5–3/2), choanosome dark orange-brown (5 YR 4–5/4). Body in both firmly rubbery, pedicels hard.

In F52071, depressions are inhalant fields (cribriporal groups). Individual ostia now minute, barely visible in reflected light at 50 \times magnification. No such well defined fields in large specimen, where ostia arranged in vaguely outlined, sinuous and confluent fields.

In dissected F52071, atrium axial in middle of body, width about equal to oscule, with lining similar in structure and thickness to ectosome. Choanosome dense, with canals rarely exceeding 100 μ m in diameter. Longitudinal primary fibres prevail in deeper choanosome, spaced 500–800 μ m in expanded body with thick, light pith and comparatively thin bark, chiefly dendritic, occasionally obliquely anastomosing, moderately straggling. Radial branches common in periphery, with tips ending inside or halfway through ectosome. Diameters of primaries (in F52071) 90–127 μ m, pith 64–74%.

Secondaries, connecting primaries with "grafted" junctions, scarce, very crooked, occasionally dendritic, 25–40 μm in diameter, with pith of highly variable diameter.

Structure of stratified ectosome not clear in larger specimen, mostly obscured by masses of mulberry-shaped microsymbionts, some scattered in peripheral choanosome. Intracortical crypts common in F52072. In smaller specimen, with less crowded microsymbionts, ectosome 520–590 μm thick. In interstitial, non-inhalant areas, stratification most pronounced: (1) outer hyaline layer about 12 μm thick; (2) middle layer, 100–120 μm thick, finely granular, almost devoid of microsymbionts; (3) inner layer, about 450 μm thick, sub-tangentially fibrous, with numerous microsymbionts. In cribriporal fields, hyaline layer thinner, also middle layer, here often packed with microsymbionts, inner layer comparatively thicker. Layers 1 + 2 traversed perpendicularly by regularly spaced very fine canals, 3–4 μm wide, spaced 12–25 μm ; many continue below, but progressively merge in wider canals (up to about 15 μm wide), in umbel-like fashion. Many proximal ends of intracortical canals join narrow zone of subcortical crypts. F52072 contains numerous oblate bodies, with thin spongin envelope of 2–3 laminae of faint radial structure (pl. 37 fig. 1). Interior finely granular, contains clearer core (occasionally eccentric) and more opaque outer zone. Total diameter 112–176 μm , diameter of cores 37–55 μm (31%–40%), width of the outer zone 28–43 μm , width of envelope 6–29 μm .

Remarks. The present species has in common with the preceding *Aplysina ianthelliformis* the hard, densely fibrous peduncle, expanded body with widely spaced, chiefly dendritic primary fibres, and irregular secondary reticulation of distinctly thinner, partly dendritic fibres (less developed in *A. lendenfeldi*). Especially the latter trait does not fit Bergquist's diagnosis, and a new genus might be needed for such species. In many other species assigned to *Aplysina*, particularly Indo-Pacific ones, with dry types only, the main skeleton is little known (Bergquist, 1980b: 492). It is therefore not unlikely that a secondary fibre reticulation, even if scarce, occurs in some massive species, and has hitherto remained undetected. A new genus is here judged premature at this stage, and the diagnosis of *Aplysina* is modified accordingly.

The "*ianthelliformis*-group" comprises a third species: *Aplysina pedunculata* (Lévi, 1969: 969, pl. 3 figs 3–5, pl. 4 figs 1–4; the last four also in Brien et al., 1973, fig. 431), from the south-eastern Atlantic. It is closest to *A. lendenfeldi*, from which it

differs externally only by its expanding, trumpet-to mushroom-shaped top, internally by thicker fibres (primaries 300–400 μm , secondaries 40–200 μm) with relatively thinner pith.

Druinellidae Lendenfeld, 1889

Synonym. Aplysinellidae Bergquist, 1980.

Remarks. Lendenfeld's name (established in 1889a: 46, as Druinellinae) has priority. The acceptance, here, of *Druinella* as valid senior synonym of *Psammaplysilla* has no influence on this priority. The latter would also apply if *Druinella* were interpreted as an invalid synonym of *Psammaplysilla*, as Bergquist did (1980b: 494), because of ICZN Article 40.

Pseudoceratina Carter

[*Dendrospongia*] Hyatt, 1875: 400 (nec *Dendrospongia* Römer, 1864).

Pseudoceratina Carter, 1885b: 204. — Bergquist, 1980b: 494, figs 23a–c (synonymy, definition, discussion, revision). — Pulitzer-Finali, 1982b: 138 (new species, discussion).

Aiolochroia Wiedenmayer, 1977a: 74 (nomen novum for *Dendrospongia* Hyatt). — Bergquist, 1980b: 494 (as *Aiolochroia*, discussion).

Diagnosis. "[Druinellidae] with sparse fibre skeleton organised on the dendritic plan typical of the family. Pith elements are present in the fibres, in some examples almost to the exclusion of the bark, which [may be] evident only as occasional peripheral patches. The matrix of the sponge is extremely dense and heavily infiltrated by collagen: the texture is hence firm, and indeed often extremely hard and incompressible." (Bergquist, 1980b: 494.) Surface commonly coarsely conulose or papillate, or rugose/pitted.

Pseudoceratina durissima Carter

Plate 17 figures 6, 8, 9, 11,

plate 37 figures 2–6

Aplysina purpurea. — Carter, 1881b: 103 (part, pl. 9 fig. 2 only, SW Australia; fide Carter, 1885b: 205, confirmed from my examination of the figured hypotype in question, BMNH 1877.5.21.1883).

Pseudoceratina durissima Carter, 1885b: 204 (Port Phillip Heads, Vic.). — de Laubenfels, 1948: 131 (invalid neotype designation). — Bergquist, 1980b: 494, fig. 23a (doubtful lectotype, as "holotype"). — Bergquist et al., 1980: 424, 425, 428 (biochemistry; Great Barrier Reef).

Aplysina laevis Carter, 1885b: 204 (Port Phillip Heads).

Material examined. Station BSS 187, four specimens (F52073–F52076). Type specimens of *Pseudoceratina durissima* and *Aplysina laevis* (BMNH). Misidentified hypotype of *Aplysina purpurea*: Carter, 1881b (BMNH).

Diagnosis. Massive, commonly with blunt crest, or thickly lamellate. Surface papillate or conulose, with conules frequently aligned in radial or meandering pattern on and below apical crest. Firmly rubbery to almost incompressible. Dark brownish red, occasionally with yellowish spots, in life; dark purple or purplish black soon after collecting and in alcohol. Alcohol and labels stained purplish. Oscules inconspicuous, apical and lateral. Surface in depressions smooth, often with fine detritus forming indistinct tangential reticulum. Choanosome very dense, with much detritus. Tendency to segregation of two morphotypes: (1) conulose, with thin ectosome, detritus often in ascending columns and round enclaves agglutinated by spongin, rare pithed fibres; (2) papillate and rugo-vermiculate, with thick ectosome, scattered to crowded detritus, prolific pithed fibres.

Description. F52073 (pl. 17 fig. 6) thickly lamellate, tongue-shaped. Base of attachment on whole lower width of erect lamella, 5 cm. Height 6 cm, thickness below 1–1.5 cm, 5–7 mm at margin.

F52074 (pl. 17 fig. 9) long thick lamella, like asymmetrical wedge, with broad truncate margin. Base of attachment interrupted by some lacunae, one wide. Specimen 12 cm long and 1–3.5 cm wide. Lamella slightly folded transversely on both sides, rises gradually from height of 2.5 cm on one side, to 6 cm above base on other. Width of truncate margin 10 to 17 mm.

F52075 (pl. 17 fig. 11) thick, blunt wedge, like outer half of waisted stone-ax. Base has outline of asymmetrical and rounded lozenge. Central crest fairly symmetrical, rising outward to height 3–4 cm on sides, then gently arched to median apex 6 cm above base. Margin rounded, 1–1.5 cm wide. Median portions of lower flanks bulging to height 2 cm above base, much more on one side, as nose-like, slightly upturned lobe. Width of base 7.5×7 cm, maximum length of wedge 9.5 cm, height in middle 6 cm.

F52076 irregular crescent, like recumbent depressed croissant cracked open along convex side. Maximum length 11.5 cm, width in middle 4.5 cm, height above base of attachment 2.2–3 cm.

Dark brownish red in life (5 R 4–5/10), occasionally with yellowish spots (in F52076), soon changed to dark purple (7.5 RP 3/2) or purplish black upon collecting, conserved in preserved specimens. Alcohol and labels stained purplish red-brown, similar residue on inside of jar not easily removed after draining first alcohol. Firmly rubbery, moderately to very little compressible, depending on amount of incorporated sand. Phenotypic variability is amenable to distinguishing two forms:

(1) F52073, F52074, with conulose surface, thin ectosome, columns and round enclaves of packed, agglutinated sand grains in periphery, rare pithed fibres; (2) F52075, F52076, with papillate to rugo-vermiculate surface, thick ectosome, regularly scattered to crowded detritus, prolific pithed fibres.

In first phenotype, surface decidedly conulose, with blunt or truncate, often composite conules, apices 0.5–1 mm wide. Conules tend to be aligned on radial ridges towards crest, where usually more prominent. Ridges spaced 3–5 mm. Many conule tips (all in F52073) much lighter, with sand grains bulging through ectosome, often piercing it.

Few small oscules on both faces of F52073; F52074, in addition, has numerous oscules of same size range (0.5–1 mm) along edge. Magnified surface of F52074 with reticulum of nervures, radial towards conule tips, single ostia in interstices. Only traces of such reticulum seen in F52073, where uniformly fine detritus at surface (in all four specimens) is mostly aggregated in vague reticulation of its own here and there.

In basal part of lamella of both specimens, choanosome almost packed with sand, thus virtually incompressible. In periphery, conules cored by tips of straggling, dendritic columns of packed sand grains, agglutinated here and there by little spongin, becoming indistinct 1–2 cm below surface. Also large round enclaves of lumped debris. Interstices always contain scattered to crowded ill-sorted debris.

Only one pithed fibre seen piercing surface in F52073 (not thoroughly sectioned). F52074 had three isolated, fairly straight to moderately straggling fibres sticking out from both sides. Neither base area revealed any fibres in thoroughly exposed choanosome. Of mounted brittle fibre fragments, some terete, one knotty, with several constrictions. Diameters $379\text{--}514\text{ }\mu\text{m}$, pith 69%–94%, bark finely stratified. Only one fibre in three hand-sections, composite, with convoluted brown spongin layers surrounding 2–3 pithed lacunae. Ectosome $50\text{--}90\text{ }\mu\text{m}$ thick and contains uniformly fine detritus, chiefly spicule fragments.

In second phenotype, surface uniformly papillate to rugo-vermiculate, with papillae about 1 mm wide, 2–4 mm apart. Surface, with low magnification, finely dotted throughout, with reticulum by slightly raised bands of fine detritus enclosing round or elongate meshes (depressions) bearing single ostia. Meshes generally wider than bands, but reversed in recessed area along convex side of F52076.

Ectosome $200\text{--}400\text{ }\mu\text{m}$ thick, fleshy, with fine crypts in inner portion, contains few scattered foreign inclusions of medium dimensions, and much

finer detritus, chiefly in outer portion. No relationship between papillae of surface and tips of fibres generally ending just below ectosome, no regular crowding of peripheral sand grains below papillae.

Ill-sorted detritus in choanosome, including coarse, angular grains, scattered in F52075, crowded in F52076. Dendritic fibres numerous, visible in both base areas and in all sections, irregularly straggling, knotty, with meandering, even knottier pith. Fibres light in reflected light. In transmitted light, finely and irregularly stratified bark brilliant yellow, pith grey to faintly yellow, occasionally opaque, almost black. In longitudinal sections, pith commonly irregular, ex-axial, with hemispherical to almost spherical accretions (reminiscent of some sphinctozoans), with inside of bark reaching into constrictions, occasionally thinly enveloping pith dissepiments. Lobed accretions of pith occasionally bud sideways.

In F52075, fibre diameters 118–139–169 μm , pith 67–79–83%. In F52076, fibres 79–118 μm , pith 48–67%.

Three specimens contain crowded microsymbionts in choanosome. In F52073, a branching and anastomosing (irregularly reticulate) filamentous alga. In F52075, irregularly oblong, occasionally polygonal bodies with a wrinkled surface, 12–15 μm long. Similar symbionts, but lobulate (like walnuts or mulberries), deep red, 10–12 μm long, permeate F52076, with filamentous alga in long strands. F52074 contains far fewer, scattered microsymbionts of mulberry-type, and smaller ones, globular or cocoon-shaped (twinned), 4–5 μm wide; anatomy thus clearly visible. Choanocyte chambers very conspicuous, large and crowded, irregularly elongate. Small ones often spherical, larger ones pear-shaped, flattened or polygonal through crowding. Length 50–93 μm , width 50–59 μm . Extreme measurements 50 \times 50 μm , 54 \times 93 μm . Larger canals, typically 200–400 μm wide, generally have thin septa, spaced 80–170 μm , commonly annulate, also reticulate, occasionally in vesicular zone along canal walls.

Remarks. Contrary to the statement in Bergquist (1980b: 494), Carter's description of this species is not "quite clear", and actually misleading. This view (see Wiedenmayer et al., in press, Annotated Bibliography, under Bergquist, 1980b, and Checklist, under *Pseudoceratina durissima*) has been confirmed by Pulitzer-Finali (1982b: 139). It is fairly obvious that Carter's description of microscopic details was based on a specimen of the first form described above, and that he thus overlooked the pithed fibres.

Druinella Lendenfeld

Druinella Lendenfeld, 1889a: 46 (monotypic definition in Spongiidae, published 28th February). — Lendenfeld, 1889b: 425. — Thiele, 1899: 24. — Wilson, 1925: 491 (discussion). — Burton, 1934a: 594 (part, fide Bergquist, 1965: 139). — de Laubenfels, 1948: 97 (part, résumé for the type species, not *Cacospongia camera*, see Bergquist, 1965: 139. — van Soest, 1978: 81). — Bergquist, 1965: 138f. (discussion, unrecognisable). — Bergquist, 1980b: 494 (as synonym of *Psammaphysilla*).

nec *Druinella*. — Burton, 1959: 269 (fide Bergquist, 1965: 139).

Psammaphysilla Keller, 1889: 358 (published 15th November). — de Laubenfels, 1948: 172 (discussion, résumé). — Bergquist, 1965: 135f. (synonymy, definition, discussion). — Bergquist, 1980b: 494 (ditto).

[*Korotnewia*] Polejaeff, 1889: 366 (nomen oblitum). — Topsent, 1905a: CLXXIV (discussion, genus inquirendum possibly related to *Psammaphysilla*). — de Laubenfels, 1936a: 32 (genus inquirendum). — Bergquist, 1980b: 494 (as synonym of *Psammaphysilla*).

Diagnosis. "[Druinellidae] in which the form of the sponge is encrusting to complex-ramose [or lobate]. The skeleton, although having the basic dendritic pattern, shows frequent fasciculation. Fibres are present in moderate quantity in relation to the matrix, and do not appear sparse and isolated as in *Pseudoceratina*. [Their distribution and cross-section are irregular, the latter bulbous-lobate, in *D. rotunda* also cavernous.] Pith is present to the exclusion of bark in the fibres, [is finely reticulate], and sand/spicule fragments may be incorporated [in variable amounts]. The texture of the sponge is compressible [to firmly] rubbery; the surface is markedly conulose, [or papillate and rugose]." (Modified from Bergquist, 1980b: 494.)

Remarks. *Druinella* is reinstated here and in Wiedenmayer et al. (in press) as a valid senior synonym of *Psammaphysilla*. All authors after Lendenfeld, including Bergquist (1965, 1980b) have overlooked the existence of the holotype of the type species, *D. rotunda* Lendenfeld, in East Berlin (see below). This is a good species, congeneric with, but distinct from *Druinella purpurea*.

Druinella rotunda Lendenfeld

Plate 17 figure 12, plate 38 figures 1–5

Druinella rotunda Lendenfeld, 1889a: 47 (in monotypic new genus). — Lendenfeld, 1889b: 427, pl. 34 figs 3, 10 (Sydney Harbour). — Wilson, 1925: 491 (in discussion). — de Laubenfels, 1948: 98 (résumé). — Bergquist, 1965: 138, 139 (discussion, holotype pronounced lost, unrecognisable from original description).

?*Psammaphysilla purpurea*. — Vacelet et al., 1976: 106 (part: pl. 5 fig. e; Tulcar Reef Complex, Madagascar).

Material examined. Station KG 5, one specimen (F52078). Type slide with five stained microtome sections, labelled by Lendenfeld (ZMB 10403).

Diagnosis. Irregularly lobate, with lobes compressed, basally concrescent; or erect-cylindrical. Very firmly rubbery, little compressible. Externally dull yellow to mustard grading to dull red and brownish purple; internally bright lemon-yellow; turning dark blue after collecting; externally purplish black, internally ochre in alcohol. Alcohol stained orange-brown, labels dark purple. Surface papillate and rugose. Oscules minute, scarce, scattered. Choanosome very dense, collagenous. Ectosome 1–1.5 mm thick. Thick, sparsely anastomosing, longitudinally fluted, cavernous fibres. Anatomy of choanosome: main canals of two types, one (exhalant) with thick sheaths containing radial apochetes, delimiting meandering and convoluted fields of crowded choanocyte chambers.

Description. Irregularly lobate, comprising four lobes, basally concrescent, compressed and contorted mostly at random. Two lobes sprawling in opposite directions, lower face of one as base of attachment. Width at base 4.5×8 cm, height 7 cm. Most of surface regularly papillate and frequently rugose, with rugae connecting neighbouring papillae (or blunt conules) in angular course. Papillae and rugae 1–2 mm wide, spacing 2–3 mm. Some interstices wider, smooth.

Choanosome, in base, bright lemon yellow in life, turned dark blue, minutes after collecting. Surface was dull yellow to mustard, grading over dull red to brownish purple (7.5 YR 7/12 and 5 R 5/6–10); uniformly purplish black in alcohol. Alcohol, even after change, orange-brown; labels inside jar and fingers upon handling stained dark purple. Very firmly rubbery, little compressible. Minute, rather scarce, flush oscules distributed at random. Surface, with low magnification, almost smooth, more often finely rugose, rugo-vermiculate or regularly pitted. Ostia, presumably in depressions, not detected.

Choanosome in alcohol very dense, collagenous, ochraceous. Deep purple ectosome generally 1 to 1.5 mm thick. Numerous commensal barnacles lodged below ectosome. Thick dendritic fibres with little colour contrast, longitudinal, often twisted fluting and slits leading to internal folds.

My sections too thick for anatomical details of interstitial choanosome. But fibre section in all regards like those in Lendenfeld's slide from holotype, described below. As in type slide, interstitially scattered mixed detritus, ill-sorted, including spic-

ule fragments. Same type of detritus in fibres. Fibres extraordinarily lobose and folded in cross-section, even more than in Lendenfeld (1889b, pl. 34 fig. 3). In fibres, pockets from marginal folds and slits reach deep inside and often communicate in axial region. Fine meshwork of pith similar to that described by Wilson (1925) and Bergquist (1965, fig. 6d), with meshsizes around 4–5 μ m. Anatomy of aquiferous system essentially as represented by Lendenfeld (1889b, pl. 34 fig. 3, obviously diagrammatic). Figure 10 of same plate (redrawn in Brien et al., 1973: 205, fig. 170) probably phantasy, such details not apparent in type slide. Spherical to ellipsoidal choanocyte chambers (17–31 μ m in greatest diameter) crowded and restricted to meandering and sinuous areas (deeply stained) between two systems of canals: (1) With thin deeply stained lining (pinacoderm) and narrow, lightly stained sheath, choanocyte chambers often almost in contact with pinacoderm. Lumina contain regularly spaced transverse septa. Inhalant canals according to Lendenfeld.

(2) With thick deeply stained lining (pinacoderm and finely fibrous layer) and wide lightly stained sheath with radial structure. Walls of lumina much convolute (meandrine) in longitudinal sections. Exhalant canals fide Lendenfeld. Prosopochetes, prosopyles, apochetes and apopyles not clearly visible, very fine. Transverse sections through type 2 suggest that apochetes get fewer and larger away from choanocyte chambers, virtually disappearing in deeply stained periphery of exhalant canals, perhaps a sphincter.

Fibres mostly surrounded by sheaths of lighter stained, concentrically structured collagenous material; choanocyte chambers sometimes almost at contact with fibres.

Remarks. The deeply lacunose fibres and the canal system are most distinctive for this species. The compressed-lobate shape of the new specimen may or may not be characteristic. Lendenfeld (1889b: 427) described his specimen (his consistent use of the plural in his descriptions is probably misleading) as "digitate, erect, cylindrical". This remains to be verified from a re-examination of the holotype. The papillae, or blunt, low conules of *D. rotunda* may be more diagnostic, in contrast to the generally taller, pyramidal conules of *D. purpurea*. The specimen figured in Vacelet et al. (1976, pl. 5 fig. e), as *Psammaphysilla purpurea*, is very similar to the new specimen externally. The presence of bristle-like fine radial canals surrounding principal canals is not unique. A similar feature was described by Kirkpatrick (1910) in a sponge from

St Helena, misidentified as *Chondrosia plebeja*, possibly identical with *Chondrosia collectrix* (Schmidt) (see Wiedenmayer, 1977a: 189). The only other species in *Druinella* is *D. purpurea* (Carter) (see Bergquist, 1965: 135, figs. 6a, b, for synonymy and description). It is encrusting, massive or repent-ramose. It is distinct from *D. rotunda* by its colour (bright green or yellow in life, reddish brown in alcohol), the mostly pyramidal tall conules, more solid fibres with frequent anastomoses, and lack of the peculiar aquiferous anatomy of *D. rotunda*.

Notes on ecology

The overlap in species composition between the stations sampled is small. Dissimilarity of stations in this respect is thought to reflect (a) high taxonomic diversity in the whole area (see below), and (b) high environmental differentiation. Environments covered herein can be grouped as:

(1) Rock substrate, mostly sloping to overhanging, with or without algal forest, with high diversity overall and vertical zonation. Sponges below the algal forest (20–30 m) tend to be large. This type of environment characterises the Kent Group and Wilsons Promontory.

(2) Level bottom below 50 m depth, substrate coarse and shelly (BSS station 187). Diversity and proportion of endemic/stenotopic species are high.

(3) Level bottom below 50 m depth, substrate muddy sand and silt, with few shells, small and delicate algae, occasionally chaetopterid worm tubes (BSS stations 179–181). Diversity is low, with sandy desmacidids (Stylotellinae) and widely distributed/eurytopic species dominating.

Taxonomic diversity

Wiedenmayer et al. (in press) listed c. 430 valid species (including Calcarea) described and recorded from Bass Strait, and from the coasts of Tasmania and Victoria, i.e. 38% of the known Australian shelf fauna. Extrapolating from percentages of new species (25%) and new records (21%) for the area in this work, the number of valid species to be expected here is in the order of 600. The relatively well known fauna of Calcarea of southern Australia comprises c. 90 species.

The diversity, in terms of recorded species, genera and families, equals or exceeds that of most provincial and regional faunas covered by recent reviews (Table 3). Only the numbers for the (chiefly western) Mediterranean and for the West Indies are larger, which doubtlessly reflects the more advanced knowledge of these faunas.

Table 4 shows that the selection of material for description in this report, though from an incom-

plete transect along the northern part of Bass Strait, is fairly representative of this province. The most conspicuous gaps, in terms of the relative importance of families and genera missed, are in the Suberitidae, Clionidae, Desmacellidae, Halichondriidae, Hymeniacidonidae, Crellidae, and Renieridae. The horny sponges are particularly well represented. No doubt the gaps reflect a very incomplete sampling of habitats.

A discussion of possible causes of this high diversity would have to consider the fossil record of siliceous sponges worldwide, and recent developments in historical biogeography, particularly with relation to other neritic benthic invertebrate groups, and to plate tectonics. This approach is far too involved in the context of this report, and will be dealt with in a separate publication. However, some salient points are outlined below.

1. Characteristics of the sedimentary substrates and hydrodynamic conditions on shelves have always been of the greatest importance to neritic sponges. This applies to individuals, local and wider populations, all phases of growth (life cycles), assemblages and provincial faunas, and hierarchic levels of time from seasonal to a few millions of years. The latter aspect, chiefly one of cycles, is thought to be particularly relevant throughout the Cenozoic.

2. The prevalent bottom facies throughout the shelf of southern Australia, from the south-west to eastern Victoria, and throughout the Cenozoic, has been that of calcarenites and calcirudites: calcareous sand and rubble, consisting chiefly of invertebrate shells, tests, and their fragments, with various degrees of penecontemporaneous accretion and cementation. In this trait, and in its extension and persistence, this shelf region is virtually unique. The dominant group of invertebrates having contributed debris to such sediments were and are Bryozoa. These are followed in importance by associated larger benthic foraminifers and coralline algae.

3. The long-term beneficial effects on populations and provincial faunas of sponges, in terms of taxonomic diversity and relatively high biomass, are not seen in the sedimentary facies alone, but also in populations of erect and ramose bryozoans. The diversity and great proliferation of such bryozoans, forming thickets and biostromes, are well documented throughout the present shelf of southern Australia (Wass et al., 1970). There is a striking correlation between richness of bryozoans and diversification/proliferation of siliceous sponges in the epicontinental Chalk Sea of Europe in the Late Cretaceous, and in similar deposits, of

Table 3. Numbers of families, genera, and species recorded or estimated in (on the basis of) reviews and checklists of regional and provincial demosponge faunas (chiefly of shelves).

Region/Province	Author/Reference	No. of families	No. of genera	No. of species
Victoria and Tasmania (Maugean Province)	This report/Wiedenmayer et al. (in press)	41	121	c. 340 (known), c. 500 (expected)
Australia (mainland and Pacific islands)	Wiedenmayer et al. (in press)	54	227	c. 1040
West Indian Region	Pulitzer-Finali (1986:193-208)	69* + (50)	218* + (161)	561* + (410)
Mediterranean (chiefly western)	Pulitzer-Finali (1983: 602-613)	61* + (57)	197* + (169)	539 + (466)
Warm-temperate eastern Atlantic	Topsent (1928), Lévi and Vacelet (1958), Borojević et al. (1968), Boury-Esnault and Lopes (1985)	52 + (40)	-	538 + (209)
Soviet Union, Arctic and Pacific seas	Koltun (1959, 1966b)	28* + (29)	78* + (92)	247* + (246)
Antarctic region and Kerguelen Province	Koltun (1966a: 7); Boury-Esnault and van Beveren (1982)	38	96	255 +
Western Japan	Hoshino (1981: 47)	28* (33)	75* (70)	205
New Zealand	Bergquist (1968, 1970); Bergquist and Warne (1980); horny sponges and Poecilosclerida not yet published	-	-	c. 350 +
New Caledonia	Lévi (1979: 307)	-	-	157
Brazil	Hechtel (1976: 237, 238)	-	-	156

*Not revised with respect to Wiedenmayer et al. (in press).

+ Includes archibenthal records

Numbers in parentheses are adjusted for taxonomic revisions and neritic components in the case of Pulitzer-Finali (1983, 1986); for taxonomic revisions only for the Soviet Union, and for Western Japan; for neritic components only for the eastern Atlantic.

Table 4. Families and genera of Demospongiae with records in the Maugean Province, extracted from Wiedenmayer et al. (in press), with revisions from this report. Asterisks denote new generic records for the province (in this report), crosses are for genera with species covered in this report.

1. Plakinidae		16. Desmoxyidae	35. <i>Higginsia</i>
2. Geodiidae	1. <i>Corticium</i> *	17. Trachycladidae	36. <i>Desmoxya</i>
3. Ancorinidae	2. <i>Geodia</i> *	18. Rhabderemiidae	37. <i>Trachycladus</i> +
4. Pachastrellidae	3. <i>Ancorina</i> +	19. Desmacellidae	38. <i>Rhabdosigma</i>
5. Coppatiidae	4. <i>Stelletta</i> +		39. <i>Biemna</i>
6. Tetillidae	5. <i>Rhabdastrella</i> *	20. Raspailiidae	40. <i>Sigmaxinella</i>
7. Spirasigmidae	6. <i>Pachamphilla</i>		41. <i>Sigmaxia</i>
8. Tethyidae	7. <i>Jaspis</i> +	21. Halichondriidae	42. <i>Raspailia</i>
9. Polymastiidae	8. <i>Asteropus</i>	22. Hymeniacionidae	43. <i>Echinodictyum</i>
10. Suberitidae	9. <i>Tetilla</i> *		44. <i>Clathriodendron</i> +
11. Spirastrellidae	10. <i>Cinachyra</i>	23. Mycalidae	45. <i>Valedictyum</i>
12. Clionidae	11. <i>Amphitethya</i>		46. <i>Halichondria</i>
13. Chondrillidae	12. <i>Trachygellius</i>	24. Desmacididae	47. <i>Ciocalypta</i>
14. Latrunculiidae	13. <i>Tethya</i> +		48. <i>Hymeniacion</i>
15. Axinellidae	14. <i>Aaptos</i>		49. <i>Stylinos</i>
	15. <i>Polymastia</i> +		50. <i>Leucophloeus</i>
	16. <i>Suberites</i>		51. <i>Mycale</i> +
	17. <i>Prosuberites</i>		52. <i>Stylotrichophora</i>
	18. <i>Rhizaxinella</i>		53. <i>Tetrapocillon</i>
	19. <i>Spirastrella</i> +		54. <i>Strongylacidon</i> +
	20. <i>Cliona</i>	25. Coelosphaeridae	55. <i>Pseudo-</i> <i>halichondria</i>
	21. <i>Chondrosia</i> +		56. <i>Psammodoryx</i>
	22. <i>Chondrilla</i>	26. Crellidae	57. <i>Burtonispongia</i>
	23. <i>Latrunculia</i> +		58. <i>Stylotella</i> *
	24. <i>Sigmosceptrella</i>	27. Myxillinae	59. <i>Phoriospongia</i> +
	25. <i>Negombata</i>		60. <i>Psammoclema</i> +
	26. <i>Axinella</i>		61. <i>Coelosphaera</i>
	27. <i>Acanthella</i>		62. <i>Amphiastrella</i>
	28. <i>Phakellia</i>		63. <i>Fusifer</i>
	29. <i>Pseudaxinella</i> +		64. <i>Crella</i>
	30. <i>Phycopsis</i>		65. <i>Pseudoclathria</i>
	31. <i>Ptilocaulis</i>		66. <i>Myxilla</i>
	32. <i>Reniochalina</i> *		67. <i>Forcepia</i> +
	33. <i>Axinosa</i>	28. Tedaniinae	68. <i>Iotrochota</i>
	34. <i>Rhaphoxya</i> +		69. <i>Fibulia</i>
			70. <i>Lissodendoryx</i> +
			71. <i>Microtylotella</i>
			72. <i>Ectydoryx</i> *
			73. <i>Strongylamma</i>
			74. <i>Waldoschmittia</i>
			75. <i>Acarnus</i>
			76. <i>Tedania</i> +

29. Anchinoidae	77. <i>Hemitedania</i>	36. Thorectidae	100. <i>Hippospongia</i>
	78. <i>Tedaniopsamma</i>		101. <i>Coscinoderma</i> +
	79. <i>Phorbas</i> *		102. <i>Leiosella</i> +
	80. <i>Plumohalichondria</i>		103. <i>Ircina</i> +
30. Microcionidae	81. <i>Hamigera</i>	37. Dysideidae	104. <i>Hyrtios</i>
	82. <i>Anaata</i>		105. <i>Sarcotragus</i>
	83. <i>Clathria</i> +		106. <i>Taonura</i>
	84. <i>Thalysias</i>		107. <i>Thorecta</i> +
31. Renieridae	85. <i>Echinoclathria</i> +	38. Darwinellidae	108. <i>Psammocinia</i>
	86. <i>Echinochalina</i>		109. <i>Fasciospongia</i> +
	87. <i>Paradoryx</i>		110. <i>Fenestraspongia</i>
	88. <i>Reniera</i>		111. <i>Dysidea</i> +
32. Callyspongiidae	89. <i>Haliclona</i>	39. Dictyodendrillidae	112. <i>Aplysilla</i> %
	90. <i>Callyspongia</i> +		113. <i>Darwinella</i> +
	91. <i>Dactylia</i>		114. <i>Dendrilla</i> +
	92. <i>Amphimedon</i>		115. <i>Pleraplysilla</i>
33. Niphatidae	93. <i>Cribrochalina</i>	40. Aplysinidae	116. <i>Chelonaplysilla</i>
	94. <i>Gelliodes</i> +		117. <i>Dictyodendrilla</i>
	95. <i>Hoplochalina</i>		118. <i>Aplysina</i> %
	96. <i>Microxina</i>		119. <i>Pseudoceratina</i> +
34. Oceanapiidae	97. <i>Oceanapia</i> +	41. Druinellidae	120. <i>Druinella</i> %
	98. <i>Spongia</i> +		121. <i>Bajalus</i>
	99. <i>Carteriospongia</i> +		

late Eocene age, in the south-eastern United States. There is indirect evidence for analogous dependence in isolated sponge spicules and bryozoans being common in Tertiary deposits of southern Australia.

4. The fossil record of siliceous sponges in the late Mesozoic and Cenozoic, at intermediate latitudes, shows that advancing seas (transgressions on shelves and in epicontinental seas) fostered diversification and proliferation, particularly when associated with latitudinal warming and low to moderate sedimentation rates within well aerated terrigenous-clastic bottom facies of normal salinity (glauconitic sands and silts), locally also with clastic vulcanites. There are obvious parallels, in such effects, between sponges and other benthic neritic invertebrates, particularly with larger foraminifers. Such conditions were common in southern Australia between Late Eocene and Middle Miocene, with such clastic facies often adjacent to, and alternating with, calcarenites, and when two successive, protracted warming pulses allowed warm-water (Tethyan) faunas to migrate to southern Australia. Mixture with endemic austral faunas is thought to have contributed to diversification of the latter.

5. The open-marine shelf faunas of southern Australia to the west of Bass Strait and along the coast of New South Wales had long independent histories before the Late Eocene, when Tasmania began to separate from Antarctica, with the South Tasman Rise subsiding. Exchange between the two old provincial faunas is likely to have occurred continuously since the Late Eocene or Oligocene (see below). The richness of the Maugean sponge fauna probably reached a peak in the Middle Miocene. The present fauna of Bass Strait, somewhat decimated by subsequent cooling, can be regarded as largely, if not wholly, relictic from this peak.

Zoogeography

Zoogeographic affinity and degree of presumed endemism on the species level are apparent from Table 5. Accordingly (discounting doubtful records) 58% is the proportion of endemics to southern Australia, while 39% is endemic to the Maugean Province. Species with Indo-Pacific records account for 33% (23% if species with

Table 5. Zoogeographic distribution of the species described in this Report. Question marks are for doubtful identifications. New records in Area D2 (Maugéan Province in Knox, 1960) are circled.

Following Ekman (1953) and Veron (1974), the boundary between the northern and southern Australian faunas is here taken to coincide with the southern limits to the distribution of hermatypic corals, i.e. at about 29°S on the west coast, and at about 30°–31° on the east coast. The northern fauna in WA thus includes that of Abrolhos Islands (Dendy and Frederick, 1924) and part of the records in Hentschel (1909–1911: Shark Bay to Geraldton). In NSW the Solitary Islands and Lord Howe Island constitute the southern bastion of coral reefs, but their sponge faunas are unknown.

Columns are numbered as follows:

- | | |
|--|--|
| 1. West Indian Region | 10. Southern Australia |
| 2. North Atlantic | 11. W. Pacific (Great Barrier Reef for Area C) |
| 3. East-Central Atlantic | 12. Japan |
| 4. South Atlantic | 13. New Zealand |
| 5. Mediterranean | 14. Central Pacific |
| 6. Red Sea | 15. N. Pacific |
| 7. Indian Ocean (plus Natal Coast) | 16. E. Pacific |
| 8. Indo-Malayan Region (WA for Area C) | 17. Subantarctic |
| 9. Northern Australia | 18. Antarctic |

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
A. Tethyan distribution (West Indies to Pacific)																		
<i>Corticium candelabrum</i>	×	×			×		×	×	×	⊗	×							
<i>Tedania anhelans</i>			×		×	×	×	×	×	×	×			×			×	
<i>Lissodendoryx isodictyalis</i>	×		×		×	×	×	×		×		×	×					×
<i>Phorbas tenacior</i>					×					?								
<i>Calyspongia pergamentacea</i>	×								×	×			×					
<i>Dysidea avara</i>		×	×		×			×		×	×			×				
<i>Aplysilla rosea</i>	×	×			×		×		×	⊗	×							?
<i>Darwinella australiensis</i>	×	×	×		×		×			×								
<i>Darwinella gardineri</i>					×	×	×			⊗								
B. With Indo-Pacific records																		
<i>Jaspis stellifera</i>									×	×	×							
<i>Tethya ingalli</i>							×	×	×	×			×					
<i>Spirastrella papillosa</i>										×	×							
<i>Chondrosia reticulata</i>										×	?			?				
<i>Trachycladus laevispirulifer</i>									×	×			×					
<i>Echinoclathria laminaefavosa</i>								×		×								
<i>Strongylacidon stelliderma</i>										×			×					
<i>Phoriospongia kirki</i>							×		×	×			×					
<i>Mycale mirabilis</i>							×		×	×			?					
<i>Calyspongia diffusa</i>							×	×	×	×	×		×	×				
<i>Calyspongia ramosa</i>							×	×	×	×			×					
<i>Calyspongia serpentina</i>										×			×					?
<i>Gelliodes incrustans</i>						×	×			×	×							
<i>Oceanapia putridosa</i>	?						?	?		⊗								
<i>Spongia hispida</i>			?				×	×	×	⊗	×		×					
<i>Carteriospongia caliciformis</i>								×		×								
<i>Carteriospongia</i> (c.f.) <i>vermicularis</i>								?		⊗								
<i>Leiosella caliculata</i>							×	×	×	×								
<i>Dendrilla cactos</i>						×		×		×								

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
C. With northern Australia records																		
<i>Geodia punctata</i>								×	×	⊗								
<i>Clathria transiens</i>									×	×	×							
<i>Echinoclathria leporina</i>									×	×	×	×						
<i>Stylotella inaequalis</i>								×	×	×	×							
<i>Phoriospongia carcinophila</i>									×	⊗	×							
<i>Psammoclema densum</i>									×	×	×							
<i>Callyspongia bilamellata</i>									×	×	×							
<i>Carteriospongia silicata</i>									×	⊗	×							
<i>Fasciospongia rimosa</i>								×	×	⊗	×							
<i>Pseudoceratina durissima</i>								×	×	×	×							
D. Southern Australia																		
D1. With records in SA, WA, NSW.																		
<i>Ancorina robusta</i>										×								
<i>Echinoclathria carteri</i>										×								
<i>Echinoclathria globosa</i>										×								
<i>Echinoclathria tubulosa</i>										×								
<i>Forcepia biceps</i>										×								
<i>Ectyodoryx maculata</i>										×								
<i>Coscinoderma pesleonis</i>										×								
<i>Leiosella levis</i>										×								
<i>Ircinia caliculata</i>										×								
<i>Thorecta choanoides</i>										×								
<i>Aplysina ianthelliformis</i>										×								
<i>Aplysina lendenfeldi</i>										×								
<i>Druinella rotunda</i>										×								
D2. Vic.-Bass Strait-Tas. coast only																		
<i>Ancorina geodides</i>										×								
<i>Polymastia crassa</i>										×								
<i>Latrunculia conulosa</i>										×								
<i>Rhaphoxya cactiformis</i>										×								
<i>Clathriodendron cacticutis</i>										×								
<i>Echinoclathria favus</i>										×								
<i>Phoriospongia argentea</i>										×								
<i>Psammoclema callosum</i>										×								
<i>Psammoclema nodosum</i>										×								
<i>Psammoclema ramosum</i>										×								
<i>Callyspongia asparagus</i>										×								
<i>Thorecta tuberculatus</i>																		
D3. Single locality only (new species)																		
<i>Ancorina repens</i>										×								
<i>Ancorina suina</i>										×								
<i>Stelletta arenitecta</i>										×								
<i>Rhabdastrella cordata</i>										×								
<i>Rhabdastrella intermedia</i>										×								
<i>Tetilla praecipua</i>										×								
<i>Latrunculia hallmanni</i>										×								
<i>Pseudaxinella decipiens</i>										×								
<i>Reniochalina sectilis</i>										×								
<i>Rhaphoxya felina</i>										×								
<i>Clathria wilsoni</i>										×								
<i>Echinoclathria egena</i>										×								

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
<i>Psammoclema bitextum</i>										×								
<i>Psammoclema fissuratum</i>										×								
<i>Psammoclema goniodes</i>										×								
<i>Psammoclema radiatum</i>										×								
<i>Psammoclema stipitatum</i>										×								
<i>Psammoclema vansoesti</i>										×								
<i>Callyspongia toxifera</i>										×								
<i>Callyspongia persculpta</i>										×								
<i>Thorecta glomeratus</i>										×								

Tethyan distribution are not counted). The overlap with northern Australia (essentially the Solanderian Province) comprises 20%. This reflects a strong Indo-West Pacific affinity of the sponge fauna of our area. The affinity is strongest to the faunas of the Indian Ocean and Indo-Malayan Region. If northern Australia is included in this group, and the Tethyan element is discounted, the overlap is 26%. The overlap with the West Pacific (without Tethyan records, but including New Zealand) is 13% (10% with New Zealand alone).

The Tethyan element (equals "cosmopolitan" of many authors) comprises 11%. This is probably a fairly constant proportion for all tropical to temperate sponge faunas. The corresponding figure over all three zoogeographic tables for West Indian species in van Soest (1978, 1980, 1984) is 13%. Interestingly the highest overlap of our collection and this group is with the Mediterranean fauna (10% in contrast to only 4% in van Soest).

Except for the widely distributed *Aplysilla rosea*, no species (with the possible exception of *Callyspongia serpentina*) has Antarctic/Subantarctic records. Such an overlap is extremely small with all the species from mainland Australia listed by Wiedenmayer et al. (in press).

There are at least 12 well known genera recorded from the southern Australian Region, which can be regarded as endemic in a wider sense. These are *Reniochalina*, *Rhaphoxya*, *Trachycladus*, *Clathriodendron*, *Stylotella*, *Psammoclema*, *Echinoclathria*, *Leiosella*, **Taonura*, *Thorecta*, **Fenestraspongia*, and **Aplysinopsis* (* not represented in the collection of this report). There have been occasional records from New Zealand, from northern Australia, and from the whole Indo-West Pacific Region. Those from tropical waters, if confirmed by modern revisions, are too isolated to suggest any other explanation than southern Australian origin for these genera. This particularly applies to *Psammoclema*, *Echinoclathria*, *Leiosella*, *Taonura* and *Thorecta*, because of their diversity and because of their pronounced habit to incorporate sand.

This unusual provinciality in sponges is perhaps best explained as relictic palaeoaustrian, originating in southern Australia in the Cretaceous to Early Tertiary, and shaped further in the Eocene-Oligocene by the final breakup of Gondwana (Zinsmeister, 1982). It is unlikely that there was one centre of origin for all these genera. According to Woodburn and Zinsmeister (1984: 938) rifting between Australia and Antarctica probably began much earlier in the south-western part than previously thought, namely in the Late Jurassic, and deep-water conditions may have extended close to Bass Strait by the Late Cretaceous (Campanian). This arm of the Tethys or Indo-West Pacific Region (roughly similar to the Red Sea in its initial phase) is known as the Austral-Indo-Pacific Province (Wilson and Allen, 1987: 45). Another likely centre of origin for endemic demosponge genera is the shelf east and north of Bass Strait, as part of the Weddellian Province (Zinsmeister, 1982). Following the detachment of Tasmania and the South Tasman Rise from Antarctica in the Late Eocene, some mixture of neritic faunal elements between the two provinces might be expected to have occurred in south-eastern Australia. Several brachiopod genera common in south-western Australia in the Palaeocene appeared in south-eastern Australia in the Eocene (Woodburn and Zinsmeister, 1984: 938, quoting McNamara). Such exchanges probably continued during the Late Oligocene (Janjukian) transgression and in later stages of high sea levels.

Evidence from other benthic groups with good fossil records, particularly molluscs (Darragh, 1985; Wilson and Allen, 1987), suggests some modifications to the above view. The degree of generic endemism in the South-east Australian Province was already high in the Late Eocene (24%), and increased substantially (to 34%) by the Pleistocene. The South-east Australian fauna was probably always a temperate assemblage, though its Tethyan or Indo-West Pacific component reached 30% in the mid-Miocene. The Austral-Indo-Pacific Province was richer in Tethyan/Indo-West Pacific

elements, and decidedly subtropical to tropical, up to early Pleistocene time. Already in the late Early Miocene, the South-east Australian Province expanded westward, and throughout the Neogene had a sharp boundary with the Austral-Indo-Pacific Province, just east of St Vincent Gulf. The South-eastern Province expanded further westward in the Pleistocene.

The high proportions of Indo-West Pacific genera and species in the Maugean demosponge fauna nevertheless call for some caution in applying molluscan biogeography. Unfortunately, apart from the lacking fossil record, the living demosponge faunas of south-western Australia and of New South Wales are not sufficiently known to resolve this question.

Phoriospongia is another sandy genus of considerable diversity and of common occurrence in southern Australia, which might be added to the endemic group of genera. It has a single well-documented record in the Tulear Reef (*Phoriospongia lamella* Lendenfeld in Vacelet et al., 1976: 63), and has a curious extension into the West-Indian Region, with four endemic species. Three of these were described from Brazil by Boury-Esnault (1973a: 283), in *Psammochela* and *Psammotoxa*, and the fourth West-Indian species is "*Holopsamma*" *helwigi* de Laubenfels, redescribed by Pulitzer-Finali (1986:147).

There is a number of genera, species pairs and groups, and species with a similar distribution, i.e. with records in Australia (in part only northern Australia), the Indo-West Pacific Region, the southern and central Atlantic (particularly West Indies), but not in the north-eastern Atlantic, Arctic and Mediterranean. These are listed below:

Stelletta debilis Thiele
Rhabdastrella Thiele
Asteropus simplex (Carter)
Spirastrella spinispirulifera (Carter)
Cliona carteri (Ridley)
Cliona carpenteri Hancock
Tethya seychellensis (Wright)
Tethya japonica Sollas
Ptilocaulis spiculifer (Lamarck)
Ectyoplasia Topsent
Mycale (Arenochalina) mirabilis Lendenfeld and M. (A.) *laxissima* (Duchassaing and Michelotti)
Neofibularia Hechtel
Desmapsamma anchorata (Carter)
Acarus innominatus Gray
Rhaphidophylus juniperinus (Lamarck) (the genus is only represented by *R. jolicoeuri* Topsent in the Mediterranean)
Strongylacidon Lendenfeld
Xestospongia testudinaria (Lamarck) and *X. muta* (Schmidt)

Cribrochalina Schmidt
Oceanapia fistulosa (Bowerbank)
Pellina carbonaria (Lamarck)
?Gelliodes Ridley (one species recorded in Mediterranean)
Amphimedon viridis Duchassaing and Michelotti
?Callyspongia Duchassaing and Michelotti (one endemic species in Mediterranean)
Callyspongia pergamentacea (Ridley)
Hyattella Lendenfeld
?Coscinoderma (West-Indian records doubtful)
Group of *Iricinia strobilina* (Lamarck), including *I. irregularis* (Polejaeff) and *I. echinata* Keller (see Vacelet et al., 1976: 102)
Smenospongia Wiedenmayer
Dictyodendrilla Bergquist
Aplysina lendenfeldi Bergquist and *A. pedunculata* (Lévi)
Pseudoceratina Carter

This distribution is best explained with the migration of elements of the palaeoaustral/Indian Ocean fauna around South Africa following the opening of the South Atlantic in the Lower Cretaceous, and the rifting between southern and central Atlantic in the Turonian, lasting as long as favourable climatic and oceanographic conditions persisted, i.e. probably until Mid-Miocene time. Reyment (1973) and Scheibnerová (1978) have argued that the South Atlantic housed a uniform zoogeographic province, which formed part of the Austral Realm up to lower Turonian time, and was until then distinct from the western Tethys/Caribbean Province. The strong influence from the southern Indian Ocean and Australia then extended to Nigeria and north-eastern Brazil (Recife), and still extended to the Sierra Leone Rise (6°N) in the Late Cretaceous. From then on mixing of faunas between central and South Atlantic occurred.

For neritic sponges, the rises and seamounts of the South Atlantic probably played an important role in this exchange, as the faunule (28 species) from the Vema Seamount described by Lévi (1969) implies. Although specific endemism is high (54%) the affinities of species are clearly mixed between North Atlantic/Mediterranean, South African, and Indian Ocean/Australian, though without typical West Indian elements. There are close ties between four of Lévi's new species and southern Australian ones: *Paresperella curvisigma* Lévi/*P. repens* Whitelegge, *Mycale diastrophella* Lévi/*M. obscura* (Carter), *Spongia violacea* Lévi/*Hippospongia anfractuosa* (Carter), and *Aplysina pedunculata* Lévi/*A. lendenfeldi*, as already mentioned.

Only nine genera in the present collection (19%) are characterised by circumtropical to warm-temperate distribution (chiefly West Indies, Mediter-

ranean, and Indo-West Pacific Region). These are *Corticium*, *Ancorina*, *Geodia*, *Spirastrella*, *Chondrosia*, *Gelliodes*, *Oceanapia*, *Fasciospongia*, and *Darwinella*.

The last group of genera that can be distinguished in our collection, is that of 20 (43%) with cosmopolitan distribution (Tethyan with extensions into either boreal or antiboreal waters, or both): *Stelletta*, *Jaspis*, *Tetilla*, *Tethya**, *Polymastia*, *Latrunculia*, *Pseudaxinella**, *Clathria*, *Mycale*, *Tedania*, *Forcepia**, *Lissodendoryx*, *Ectyodoryx*, *Phorbas*, *Spongia*, *Ircinia*, *Dysidea*, *Aplysilla*, *Dendrilla*, and *Aplysina*.

The three genera marked by asterisks have no Antarctic/Subantarctic records.

The Antarctic fauna is characterised by the rarity or absence of members of the Ancoronidae, Geodiidae, and Tethyidae, and of horny sponges. It could be argued that most of the Antarctic records are archibenthic and therefore not suitable for comparison with the shelf-fauna of southern Australia. The numerous records from depths less than 100 m at Kerguelen, Heard and Macquarie Islands (Koltun, 1976; Boury-Esnault and van Beveren, 1982) do not support such a view, nor does the shallow-water fauna of Tierra del Fuego described by Sarà (1978).

Some questions relating to these affinities and to the high degree of specific endemism of the Magellan demosponge fauna remain to be answered. The most relevant ones can be formulated as follows:

1. Why is the affinity with the faunas of the Indian Ocean and of the Indo-Malayan Region so strong?
2. Why is the affinity with the Mediterranean fauna unexpectedly high, with several species in common or closely related?
3. Why is the affinity with the fauna of New Zealand so weak?
4. Why is the affinity with the Antarctic and Subantarctic faunas almost nonexistent?
5. How did the "sandy sponges", a very important sector (in diversity and density) of the endemic genera of southern Australia, originate?

Again, attempts to reasonably answer these questions, with adequate discussions, will have to await separate publication. But preliminary suggestions are given below, with a minimum of references to the pertinent literature.

1. Affinity with faunas of Indian Ocean and Indo-Malayan Region. This question has been partly answered above. Protracted episodes of warming at high latitudes in the Palaeocene to Late Eocene, and in the Early to Middle Miocene allowed a con-

siderable number of warm-water, neritic invertebrate taxa to colonise the entire shelf of southern Australia. This is well documented in groups such as molluscs (Wilson and Allen, 1987), larger foraminifers, brachiopods, bryozoans, and, among sponges, by lithistids and inozoans (pharetronids of authors). In terms of density (biomass), bryozoans, coralline algae, foraminifers, molluscs (gastropods, bivalves), and brachiopods were most important among the immigrants, resulting in the wide distribution of shelly-bioclastic (calcarenitic-ruditic) facies, with its beneficial effect on sponges, as already mentioned. Besides increasing water temperatures, changing oceanographic patterns in the Oligocene and Miocene (see below, under 4), particularly the heavy influx of surface currents from the eastern Indian Ocean (indicated by carbonate sedimentation) must have aided this mixing and augmentation of benthos, both by oceanic transport of dissemules, and by neritic range extensions. The latter avenue was probably substantially complemented in the Miocene by the system of ridges and plateaus between India and south-west Australia (Cook, 1977: 146, Fig. 13F). Furthermore, the peripheral influence of the Circum-Antarctic Current and of upwelling deeper water rich in dissolved silica and nutrients is assumed to have influenced the proliferation of the southern Australian demosponge fauna.

2. Affinity with Mediterranean fauna. It is chiefly this affinity which has prompted the use of the term (relictic) *Tethyan* in the context of Table 5. For neritic taxa, the term is largely synonymous with "cosmopolitan" of most authors.

There are at least 35 such cases of species, or groups of closely related species, to be expected in the Australian neritic demosponge fauna, mostly with records in the south. About two-thirds of these have West-Indian records; several also have records in New Zealand, and some have apparently widely disjunct distribution, without records in the Indian Ocean, or Atlantic only, not Mediterranean. Sponges share with some other groups of sessile invertebrates their very poor larval dispersal capabilities, and the seeming paradox of having very large geographic ranges in many species, nonetheless. Scheltema (1986: 311) argued that such species are commonly members of the fouling community, have widely disjunct distribution, mostly restricted to harbours, and that this distribution is best explained with shipping.

Several arguments can be advanced against this view. Probably the most important one is that Scheltema did not consider well studied fossils, for instance the geographic range of some species of

Nummulites and related genera, the larger foraminifers dominating the Eocene Tethys, from western Europe as far east as the western Pacific (Premoli-Silva and Brusa, 1981). Related to this argument is the probability of non-larval trans-oceanic transport of sessile shallow-water benthos by rafting on algae, sea grass and mangrove root fragments throughout the Cenozoic (Brasier, 1975; McCoy and Heck, 1976; Eva, 1980), which is a much more viable alternative to the shipping hypothesis.

By analogy with molluscs and scleractinian corals, it is very likely that the species and species-groups in question are at least as old as Early Miocene, if not Oligocene. The closure of the Mediterranean in the Late Miocene would thus have had little if any effect on geographic ranges of these species.

3. Affinity with fauna of New Zealand. The microcontinent of New Zealand (with the plateaus and rises adjoining the present islands) began to separate from south-eastern Australia in the Late Cretaceous (Late Campanian). Seafloor-spreading was fast, and the Tasman Sea had reached its present width at the end of the Palaeocene (c. 56 Mybp). There was no spreading later, except further south (Owen, 1983).

According to Kauffman (1973: Fig. 5, p. 362f.), the degree of endemism of the bivalve fauna of New Zealand was weak in the Early Cretaceous, but increased markedly in the Cenomanian, supposedly in relation to major marine flooding during global transgression at this time. This strong endemism was conserved to the end of the Cretaceous and seems to have fluctuated in the Tertiary. Zinsmeister (in Woodburn and Zinsmeister, 1984: 938) found little similarity, in shallow-water mollusc faunas of the Late Cretaceous and Palaeocene, between south-eastern Australia and New Zealand. Darragh (1985) found that 30% of the molluscan genera in the early Tertiary of the South-east Australian Province occurred in the coeval fauna of New Zealand, and that this proportion dropped to 17% by the Pliocene and Pleistocene.

Though no such data are available for neritic sponges, it can be speculated that this sector of the New Zealand fauna had a similar evolution. There are also signs, however, of strong influx of warm-water taxa from the north, throughout New Zealand, in the Late Eocene and Early Oligocene, just as in southern Australia: The diverse spicule assemblage in the Oamaru Diatomite (south-eastern coast of southern New Zealand), described by Hinde and Holmes (1892), is associated with a rich assemblage of larger neritic foraminifers very simi-

lar to coeval ones in the western tropical Pacific and Indo-Malayan Region.

4. Affinity with Antarctic and Subantarctic faunas. The Circum-Antarctic Current, and oceanic conditions between Australia and Antarctica, were fully established in the Late Oligocene, following the subsidence of the South Tasman Rise into deeper water, and the opening of Drake Passage. In the Late Eocene there was a continuum in faunas and floras between the subtropical belt along southern Australia and New Zealand, and the warm-temperate zone around Antarctica. The Circum-Antarctic Current had the effect of "locking in" the Antarctic and Subantarctic fauna, fully exposing it to increasing cooling, and contributing to its present uniformity. From the Early Oligocene on, the southern end of Tasmania moved to the north, away from the 60° parallel. The boundary between cold surface waters of the Subantarctic Zone and the warmer waters over the southern Australian shelf, continental slope, and Great Bight Abyssal Plain became sharp in the Middle to Late Miocene.

The separation of biogeographic provinces at this time was partly due to the steep temperature gradients and partly to a threshold related to phytoplankton and thus to different trophic systems. This is indicated by the asymmetrical distribution (with relation to the axis of seafloor-spreading along the crest of the South-east Indian Ridge) of, and sharp boundaries (vertical and horizontal) between, biogenic fine sediments on the floor of the Southern Ocean. These were supplied by phytoplankton in superficial waters: siliceous (chiefly diatoms), in the southern portions, and calcareous (nannoplankton, coccolithophorids) adjoining the southern Australian shelf. The biosiliceous pelagic facies is largely coextensive with ice-rafted detritus. West of Tasmania, the pelagic sediment in lower bathyal and abyssal areas tend to be exclusively calcareous throughout the Miocene, north of the South-east Indian Ridge. The crest of this ridge then formed the boundary with the biosiliceous facies to the south, and only in the Early Pliocene did this boundary shift to the northern flank of the rise (Kemp et al., 1975). The sedimentary cover of the South Tasman Rise is known to consist entirely of pelagic carbonates, after the Oligocene.

The present Antarctic Convergence (Polar Front) approximately coincides with the pelagic facies boundary along the northern flank of the South-east Indian Ridge south of Australia, until off the southern end of the South Tasman Rise. Further east it turns southward, the again eastward, skirt-

ing the Campbell Plateau. This boundary is thought to have been installed south of the Campbell Plateau already in the earliest Oligocene. The sedimentary cover of the Campbell Plateau at its southern end (stratigraphically continuous only in the Palaeogene) consists entirely of calcareous pelagics. The steepening of temperature gradients of surface waters in the New Zealand region occurred gradually throughout the Oligocene and Early Miocene, and the present oceanographic configuration (Subtropical Convergence) developed during the Middle Miocene (Murphy and Kennett, 1986; Kennett and von der Borch, 1986).

Recent syntheses in palaeoceanography thus support the notion that the neritic benthic faunas of the Maugean Province and of New Zealand, though having evolved independently since the Late Cretaceous, were subjected to similar climatic conditions. In both provinces, the strong influx of warm-water taxa in the Late Eocene was largely conserved by gradual adaptation to falling temperatures, and by regional permanence of suitable sedimentary substrates.

5. Sandy sponges. A discussion of this question would have to consider incorporation of sand by sponges in general, and thus chiefly aspects of life cycles and functional morphology. A starting point would be the only paper wholly dedicated to the phenomenon of sand in sponges, that of Shaw (1927b). It seems doubtful that much could be added without detailed field observations and controlled experiments.

Uptake of sand occurs in many species and genera, distributed among many families and orders of demosponges, occasionally also in Calcareia. The proportions of sand to whole sponges, and distribution with respect to skeleton, ectosome and choanosome are often variable. In some species, these proportions seem to be regular, while in others the uptake of sand is obviously facultative.

We have few data on the biogeographic significance of the phenomenon and on the role of evolution, since the fossil record tells us nothing in this respect.

As a preliminary hypothesis, it can be speculated that the strong and obligatory content of sand in many species and genera endemic to (southern) Australia (e.g. *Echinoclathria*, *Stylotellinae*, several *Thorectidae*) may be the result of the prevalence, over long periods, of sandy substrates in this shelf region, of associated hydrodynamics, and of adaptive response by particular taxa, presumably since the Palaeocene (the time when the calcarenitic bryozoan-algal facies appeared in the north-west and gradually spread along the southern shelf).

The benefit by uptake of sand is seen in regulating specific gravity to counter mobility of the substrate and thus to facilitate recruitment and early growth. Optimal density, once attained, would be conserved in adult sponges because it would offer further advantages in propagation. In the case of larval settling and recruitment, weak and more or less permanent substrate mobility, at normal wave base and within the range of tidal currents, would be the chief controlling factor (Wiedenmayer, 1978). In adults of the same sponges, rolling and fragmentation by storm-wave action could be exploited to promote propagation and controlled range extension (facies tracking) (Battershill and Bergquist, 1985).

Parallels can be seen with the life cycles and survival strategies of fast growing, porous, branching scleractinians in shallow water, particularly *Acroporidae* (Jackson and Hughes, 1985); but also with lithistid demosponges (having thrived in shelly-calcarenitic facies since the Middle Cambrian), where the interlocking main skeleton should not be seen merely as strengthening of the adult sponge body in fixed position.

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Plates 1-38

Unless otherwise stated, all scales with specimens (pls 1-17) represent 2 cm. All scales with photomicrographs (pls 18-38) represent 200 μ m.

Plate 1

- Fig. 1. *Corticium candelabrum* Schmidt, NMV F51927, $\times 0.87$.
- Fig. 2. *Ancorina geodides* Carter, NMV F51929 before preservation, $\times 0.46$.
- Fig. 3. *Ancorina repens* sp. nov. Holotype, NMV F51930, $\times 0.52$.
- Fig. 4. *Ancorina robusta* Carter, NMV F51931, $\times 0.52$.
- Fig. 5. *Ancorina suina* sp. nov. Holotype, NMV F51934, $\times 0.87$.
- Fig. 6. *Stelletta arenitecta* sp. nov. Paratype, NMV F51942, $\times 0.53$.
- Fig. 7. *Rhabdastrella cordata* sp. nov. Holotype, NMV F51935, (left), and *Tedania anhelans* (Lieberkühn), NMV F52013 (right), photographed in situ. $\times 0.64$.
- Fig. 8. *Rhabdastrella intermedia* sp. nov. Holotype, NMV F51936, $\times 0.64$.

Plate 2

- Fig. 1. *Geodia (Geodia) punctata* Hentschel. NMV F51937, $\times 0.46$.

Fig. 2. *Jaspis stellifera* (Carter). NMV F51938, partially surrounding a group of vermetids, a mouth of which is visible on top. The cushion-shaped, perpendicularly cut small sponge on the left shoulder is *Gelliodes incrustans* Dendy (NMV F52036). Behind it (extreme upper left) is *Aulorrhiza procumbens* (Lendenfeld, Calcarea, not described). $\times 0.64$.

Figs 3, 4. *Tetilla praecipua* sp. nov. Holotype, NMV F51943. Fig. 3. Lateral view, $\times 0.81$. Fig. 4. Choanosome from below, $\times 0.7$.

Figs 5, 6, 9. *Tethya ingalli* Bowerbank. Fig. 5. NMV F51944, $\times 0.7$. Fig. 6a-d. *Tethya philippensis* Lendenfeld, two wet syntypes, AM G9077, $\times 0.96$. Fig. 6a, b. Top. Fig. 6c, d. Bottom. Fig. 9. *Tethea cliftoni* Bowerbank, dry holotype, BMNH unregistered (Box D.A. 38), lateral view, $\times 0.64$. Note the long pedicels rising from a composite cemented cobble, and Bowerbank's autograph label.

Figs 7, 8. *Polymastia crassa* Carter. Fig. 7. NMV F51945, before preservation, $\times 0.38$. Fig. 8. NMV F51946, $\times 0.73$.

Figs 10, 11. *Spirastrella papillosa* Ridley and Dendy. Fig. 10. NMV F51948, $\times 0.32$. Fig. 11. NMV F51949, $\times 0.38$.

Plate 3

Figs 1-6. *Chondrosia reticulata* (Carter). Fig. 1. NMV F51951, $\times 0.76$. Figs 2, 3. *Chondrosia spurca* Carter, wet holotype BMNH 1886.12.15.128, top and sectioned bottom, $\times 0.4$. Figs 4, 5. Two wet syntypes or two halves of one syntype of *Reniera collectrix* Lendenfeld, AM G9014. Fig. 4. $\times 0.38$. Fig. 5. $\times 0.43$. Fig. 6a-c. Wet dissected syntype of *Chondrosia collectrix* Lendenfeld, AM G9061, $\times 0.76$.

Fig. 7. *Latrunculia conulosa* Hallmann, NMV F51954 before preservation, $\times 0.49$.

Figs 8-10. *Latrunculia hallmanni* sp. nov. Fig. 8. Holotype, NMV F51953, $\times 0.43$. Fig. 9. Paratype, NMV F51956, $\times 0.6$. Fig. 10. Paratype, NMV F51957, $\times 0.76$.

Fig. 11. *Pseudaxinella decipiens* sp. nov. Holotype, NMV F51961, $\times 0.96$.

Plate 4

Fig. 1. *Reniochalina sectilis* sp. nov. Holotype, NMV F51962, $\times 1.04$.

Fig. 2a, b. *Reniochalina lamella* Lendenfeld. Dry schizosyntype, BMNH 1925.12.1.18, East Coast, $\times 0.78$. Lendenfeld's sketch of the discarded specimen shows the original position (hatched) of the schizotype.

Fig. 3a, b. *Reniochalina stalagmitis* Lendenfeld. Dry syntype, BMNH 1887.4.27.122 (with autograph label), $\times 0.26$ Fig. 4. *Reniochalina spiculosa* Lendenfeld ms. Dry specimen, Port Jackson, BMNH 1887.4.27.119, $\times 0.38$.

Fig. 5a, b. *Reniochalina arborea* Lendenfeld ms. Dry specimen, New Zealand, BMNH 1887.4.27.117, $\times 0.46$. Lendenfeld's sketch as for *R. lamella*.

Figs 6-12. *Rhaphoxya cactiformis* (Carter). Fig. 6. NMV F51963, $\times 0.6$. Figs 7, 8. *Acanthellina rugolineata* Carter, wet syntype, BMNH 1886.12.15.94. Fig. 7. Side, $\times 0.49$. Fig. 8. Top, $\times 0.6$. Fig. 9. *Acanthellina parvicornulata* Carter, wet holotype, BMNH 1886.12.15.56, $\times 0.35$. Figs 10, 11. *Acanthella hirciniopsis* Carter, wet

schizosyntype (part of base of large specimen, cut sagittally and transversally), $\times 0.32$. Fig. 10. View of sagittal section showing mesial condensation. Fig. 12. *Acanthella hirciniopsis* Carter, wet syntype, BMNH 1886.12.15.48, $\times 0.46$.

Plate 5

Figs 1–3. *Rhaphoxya cactiformis* (Carter), dry specimens. Figs 1, 2. *Acanthellina rugoslineata* Carter, syntypes. Fig. 1. BMNH 1886.12.15.444, $\times 0.32$. Fig. 2. BMNH 1886.12.15.365, $\times 0.53$ (label, except register number, in Carter's hand). Fig. 3. *Acanthella cactiformis* Carter, paralectotype, BMNH 1884.10.10.2, $\times 0.15$. Note the similarity (as for Fig. 1) with *Spongia cardius* Lamarek, redescribed as *Acanthella* by Topsent (1930: 40), assigned to *Phakellia* by Bergquist (1970).

Fig. 4. *Rhaphoxya felina* sp. nov. Holotype, NMV F51964, $\times 0.53$.

Fig. 5. *Trachycladus laevispirulifer* Carter. NMV F51965, $\times 0.67$.

Figs 6, 7. *Clathriodendron cacticutis* (Carter). Fig. 6. NMV F51966, $\times 0.43$. Fig. 7. *Dictyocylindrus cacticutis* Carter, wet holotype, BMNH 1886.12.15.120, $\times 0.58$.

Fig. 8. *Clathria transiens* Hallmann. NMV F51980, $\times 0.46$.

Fig. 9. *Clathria wilsoni* sp. nov. Holotype, NMV F51967, $\times 1.4$.

Fig. 10. *Echinoclathria favus* Carter. NMV F51972, $\times 0.53$.

Fig. 11. *Echinoclathria laminaefavosa* (Carter). NMV F51971, $\times 0.39$.

Plate 6

Fig. 1. *Echinoclathria leporina* (Lamarek). NMV F51974, detail from central portion, before preservation, $\times 0.35$.

Figs 2–5, 7. *Echinoclathria globosa* (Lendenfeld). Fig. 2. NMV F51975, $\times 0.87$. Fig. 3. NMV F51976, $\times 0.78$. Fig. 4. *Halme globosa* Lendenfeld, only extant syntype, wet BMNH 1886.8.27.71, Port Phillip Bay, $\times 0.81$. Fig. 5. *Halme micropora* Lendenfeld, dry syntype, AMG8828, Illawarra, $\times 0.38$. Fig. 7. *Holopsamma crassa* Carter, dry syntype, BMNH 1886.12.15.313, S. coast, $\times 0.49$.

Fig. 6. *Phoriospongia reticulum* Marshall, wet holotype, ZMB 2634, $\times 1.4$.

Fig. 8. *Echinoclathria egena* sp. nov. Holotype, NMV F51978, $\times 0.61$.

Fig. 9. *Echinoclathria tubulosa* (Hallmann). NMV F51979, $\times 0.76$.

Figs 10, 11. *Strongylacidon stelliderma* (Carter). Fig. 10. NMV F51981, $\times 1.6$. Fig. 11. *Halichondria stelliderma* Carter, wet holotype, BMNH 1886.12.15.148, $\times 0.67$.

Plate 7

Figs 1, 2. *Stylotella inaequalis* (Hentschel). Fig. 1. NMV F51983, $\times 2.16$. Fig. 2. NMV F51988, $\times 1.04$.

Figs 3–7. *Phoriospongia argentea* (Marshall). Fig. 3. NMV F51989, $\times 1.13$. Fig. 4. *Dysidea argentea* Marshall, wet holotype, PMJ Porif. 136, X 1.57. Figs 5–7. *Chondropsis arenifera* Carter, wet syntypes. Figs 5, 6. BMNH 1886.12.15.149. Fig. 5. Exterior, $\times 0.52$. Fig. 6. Interior, $\times 0.54$. Fig. 7. BMNH 1886.12.15.54, $\times 0.64$.

Figs 8, 9. *Phoriospongia carcinophila* (Lendenfeld). Fig. 8. NMV F51990, $\times 0.7$. Fig. 9. NMV F51991, $\times 1.7$.

Figs 10–12. *Phoriospongia kirki* (Bowerbank). Fig. 10. *Dysidea kirki* Bowerbank, dry syntype?, Bowerbank Collection, BMNH 1872.5.21.50, Swan River (Perth), W.A., $\times 0.48$. Fig. 11. *Dysidea favosa* Marshall, portion of wet holotype, PMJ Porif. 125, $\times 0.55$. Fig. 12. NMV F51993, $\times 0.64$.

Fig. 13. *Psammoclema bitextum* sp. nov. Holotype, NMV F51996, $\times 0.72$.

Plate 8

Fig. 1. *Psammoclema callosum* (Marshall). NMV F51997, $\times 1.1$.

Figs 2–4. *Psammoclema densum* (Marshall). Fig. 2. NMV F51998, $\times 0.55$. Fig. 3. NMV 52000, $\times 1.1$. Fig. 4. *Psammopemma densum* Marshall, wet holotype, ZMB 2631, $\times 2.1$. Scale 1 cm.

Fig. 5. *Psammoclema fissuratum* sp. nov. Holotype, NMV F52002, $\times 1.04$.

Figs 6, 7. *Psammoclema goniodes* sp. nov. Fig. 6. Paratype, NMV F52059, $\times 2.1$, scale 1 cm. Fig. 7. Holotype, NMV F52060, $\times 0.81$.

Figs 8–12. *Psammoclema nodosum* (Carter). Figs 8–11. *Sarcocornea nodosa* Carter, dry types. Figs 8–10. Perpendicularly cut paralectotype, BMNH 1886.12.15.297. Fig. 8. Top view, $\times 1.02$. Fig. 9. Interior, $\times 0.67$. Fig. 10. Side view, $\times 0.52$. Fig. 11. Lectotype, BMNH 1886.12.15.295, $\times 0.38$. Fig. 12. NMV F52003, $\times 0.38$.

Plate 9

Figs 1, 2. *Psammoclema radiatum* sp. nov. Holotype, NMV F52004, $\times 0.46$. Fig. 1. Side view. Fig. 2. Top view.

Figs 3–6. *Psammoclema ramosum* Marshall. Fig. 3. NMV F52005, top, $\times 0.48$. Figs 4–6. Fragments from wet holotype, PMJ Porif. 134. Fig. 4. Top, $\times 0.78$. Fig. 5. Longitudinal section, $\times 1.13$. Fig. 6. Bottom, $\times 0.78$.

Fig. 7. *Psammoclema stipitatum* sp. nov. Holotype, NMV F52006, $\times 0.58$.

Figs 8–10, 13. *Mycale (Arenochalina) mirabilis* Lendenfeld. Fig. 8. NMV F52017, $\times 0.58$. Figs 9, 10. NMV F52015. Fig. 9. Preserved specimen, $\times 0.54$. Fig. 10. Before preservation, $\times 0.35$. Fig. 13. Sectioned dry holotype, BMNH 1886.8.27.587, $\times 0.67$.

Figs 11, 12. *Psammoclema vansoesti* sp. nov. Fig. 11. Holotype, NMV F52008, $\times 0.43$. Fig. 12. Paratype, NMV F52007, $\times 0.32$.

Plate 10

Figs 1, 2. *Mycale (Arenochalina) mirabilis* Lendenfeld. NMV F52016. Fig. 1. Before preservation, $\times 0.34$. Fig. 2. Preserved specimen, $\times 0.64$.

Figs 3–7. *Tedania anhelans* (Lieberkühn). Fig. 3. NMV F52012, $\times 0.56$. Figs 4–6. Wet Hypotypes of *Tedania digitata*: Dendy (1895). Fig. 4. NMV RN796, Sorrento jetty, $\times 0.67$. Figs 5, 6. NMV RN871. Fig. 5. Interior with embryos, $\times 0.57$. Fig. 6. Top, $\times 0.56$. Fig. 7. *Tedania rubicunda* Lendenfeld, wet syntype, AM G9146, $\times 0.46$.

Figs 8–11. *Forcepia biceps* (Carter). Figs 8, 9. NMV F52018. Fig. 8. Top, $\times 0.35$. Fig. 9. Transverse fracture, $\times 0.93$. Fig. 10. *Forcepia colonensis*: Carter (1885a), dry hypotype with Carter's label, BMNH 1886.12.15.363,

×0.46. Fig. 11. *Suberites biceps* Carter, wet holotype, BMNH 1886.12.15.52, Port Phillip Heads, ×0.5.

Fig. 12a, b. *Lissodendoryx isodictyalis* (Carter). NMV F52019, ×1.04.

Plate 11

Figs 1, 2. *Myxilla isodictyalis*: Dendy (1896), wet hypotype, NMV RN778, Sorrento jetty. Fig. 1. Top, ×0.71. Fig. 2. Transverse section, ×0.74.

Figs 3, 4. *Ectyodoryx maculata* Hentschel. Fig. 3. NMV F52021, ×0.78. Fig. 4. NMV F52020, ×0.93.

Figs 5a, b. *Phorbas* cf. *tenacior* (Topsent). NMV F52022, ×0.9.

Fig. 6. *Callyspongia asparagus* (Lamarck). NMV F52024, ×0.93.

Fig. 7. *Callyspongia bilamellata* (Lamarck). Dry hypotype of Carter (1885d, as *Cavochalina bilamellata*), BMNH 1886.12.15.184, Westernport Bay, Victoria, ×0.13 (scale = 5 cm).

Figs 8–10. *Callyspongia diffusa* (Ridley). Fig. 8. NMV F52026, ×0.32. Fig. 9. *Cladochalina diffusa* Ridley, dry paralectotype, BMNH 1882.10.17.6, Singapore, ×0.33.

Fig. 10. *Pachychalina manus* Lendenfeld, wet syntype, AM G8927, ×0.33.

Fig. 11. *Callyspongia ramosa* (Gray). NMV F52028, ×0.75.

Plate 12

Figs 1–3. *Callyspongia pergamentacea* (Ridley). Fig. 1. NMV F52027, ×0.49. Fig. 2. *Chalinopora paucispina* Lendenfeld, dry holotype (syntype?), BMNH 1886.8.27.413, Queenscliff, Victoria, ×0.46. Fig. 3. *Chalinopora typica* Lendenfeld, dry syntype, BMNH 1886.8.27.411, Port Phillip Bay, Victoria, ×0.34.

Fig. 4. *Callyspongia serpentina* (Lamarck). NMV F52029, ×0.29.

Fig. 5. *Callyspongia toxifera* sp. nov. Holotype, NMV F52032, ×1.08.

Fig. 6. *Callyspongia persculpta* sp. nov. Holotype (part), NMV F52035, ×0.57.

Fig. 7. *Gelliodes incrustans* Dendy. NMV F52036, attached to *Jaspis stellifera*, ×1.1.

Fig. 8. *Oceanapia putridosa* (Lamarck). NMV F52037, ×0.38.

Figs 9–12. *Spongia hispida* Lamarck. Fig. 9. NMV F52038, ×0.355. Fig. 10. NMV F52039, ×0.77. Fig. 11. *Euspongia irregularis* var. *jacksonia* Lendenfeld, wet syntype, AM Z498, ×0.41. Fig. 12. *Euspongia irregularis* var. *silicata* Lendenfeld, wet syntype, AM G3962, ×0.6.

Plate 13

Figs 1–7. *Carteriospongia caliciformis* Carter. Fig. 1. NMV F52040b, ×0.43. Figs 2, 3, 6, 7. Dry syntypes. Figs 2, 3. BMNH 1886.12.15.214. Fig. 2. Underside, with labels by Carter (right) and Lendenfeld (left), ×0.3. Fig. 3. Concavity, ×0.35. Figs 6, 7. BMNH 1886.12.15.215, ×0.23. Fig. 6. Underside. Fig. 7. Concavity. Figs 4, 5. NMV F52040a. Fig. 4. Detail of concavity and inner rim, ×0.56. Fig. 5. Lateral view, ×0.29.

Figs 8–12. *Carteriospongia silicata* (Lendenfeld). Figs 8–10. NMV F52048, before preservation, from top, from

below, and from one side, respectively, ×0.45. Figs 11, 12. Dry holotype, BMNH 1886.8.27.32, Torres Strait. Fig. 11. From above, ×0.46. Fig. 12. From below, ×0.41.

Plate 14

Figs 1–5. *Carteriospongia silicata* (Lendenfeld). Dry hypotypes of *Carteriospongia elegans*: Burton (1934a:600). Note that the (correct) identification on the labels departs from the published one. Figs 1, 2. BMNH 1893.3.4.24, Great Barrier Reef, bottom and top, respectively, ×0.32. Figs 3–5. BMNH 1893.3.4.63, Bass Strait, side, top and bottom, respectively. Fig. 3. ×0.55. Fig. 4. ×0.46. Fig. 5. ×0.38.

Fig. 6. *Carteriospongia* cf. *vermicularis* (Lendenfeld). NMV F52041, ×1.13.

Figs 7, 9. *Coscinoderma pesleonis* (Lamarck). Fig. 7. NMV F52042, ×0.55. Fig. 9. NMV F52044 in situ, ×0.58.

Figs 8, 10. *Leiosella caliculata* Lendenfeld. Fig. 8. NMV F52046, ×0.46. Fig. 10. *Euspongia compacta* Carter. Dry lectotype, BMNH 1877.5.21.1899, "S. Australia", ×0.46.

Plate 15

Figs 1–5. *Leiosella caliculata* Lendenfeld. Fig. 1. Dry syntype, BMNH 1955.4.7.1, ×0.45. Figs 2, 3. *Euspongia infundibuliformis* Carter, dry lectotype, BMNH 1886.12.15.222, figured in Lendenfeld (1889b, pl. 13, fig. 7) as *Leiosella compacta*. Fig. 2. Concavity, ×0.28. Fig. 3. Detail of concavity and inner rim, ×1.04. Figs 4, 5. *Geelongia vasiformis*: Dendy ms., dry composite specimen from Victoria, BMNH 1925.11.1.887, ×0.21. Fig. 4. Open side, showing the partition formed by the wall of the almost complete primary vase in the background, and the half-formed secondary vase. Fig. 5. Convex side.

Figs 6, 7. *Leiosella levis* (Lendenfeld). Fig. 6. NMV F52047, ×0.35. Fig. 7. One of the misidentified dry paralectotypes of *Euspongia compacta* Carter, BMNH 1877.5.21.1900, Port Fairy, Victoria, here assigned to *Leiosella levis*, ×0.32.

Figs 8–10. *Ircinia caliculata* Lendenfeld. Figs 8, 9. NMV F52049. Fig. 8. Open concavity, ×0.32. Fig. 9. Convex side, ×0.29. Fig. 10. Open concavity of dry syntype, BMNH 1886.8.27.358, with Lendenfeld's label. ×0.35.

Plate 16

Figs 1–3. *Thorecta choanoides* (Bowerbank). Fig. 1. NMV F52050, ×0.26. Figs 2, 3. *Stelospongia flabeliformis latus* Carter, misidentified dry paralectotype, BMNH 1886.12.15.219. Fig. 2. Narrow side, with Lendenfeld's identification "*Thorecta exemplum* var. *secunda*" on the back of Carter's label, ×0.27. Fig. 3. Broadside, ×0.21.

Figs 4, 5. *Thorecta glomeratus* sp. nov. Holotype, NMV F52052. Fig. 4. Before preservation, 0.55. Fig. 5. Preserved specimen, ×0.48.

Figs 6, 7, 10. *Thorecta tuberculatus* (Carter). Figs 6, 7. Dry holotype, BMNH 1886.12.15.446. Fig. 6. ×0.46. Fig. 7. Detail of opposite side, ×1.04. Fig. 10. NMV F52053, ×0.68.

Fig. 8. *Aplysilla rosea* (Barrois). NMV F52061, ×1.02.

Fig. 9. *Dysidea avara* (Schmidt). NMV F52057, ×1.02.

Fig. 11. *Fasciospongia rimosa* (Lamarck). NMV F52056, $\times 0.33$.

Fig. 12. *Darwinella australiensis* Carter. NMV F52064, $\times 1.04$.

Plate 17

$\times 1$ Figs 1, 2. *Darwinella australiensis* Carter. Fig. 1. NMV F52063, $\times 0.93$. Fig. 2. Four dissected wet syntypes, BMNH 1887. 7.11.10, $\times 0.45$.

Figs 3, 7. *Darwinella gardineri* Topsent. Fig. 3. NMV F52066, before preservation, $\times 0.47$. Fig. 7. NMV F52065, $\times 0.98$.

Figs 4, 5. *Aplysina lendenfeldi* Bergquist. Fig. 4. NMV F52071, $\times 0.58$. Fig. 5. NMV F52072, before preservation, $\times 0.3$.

Figs 6, 8, 9, 11. *Pseudoceratine durissima* Carter. Fig. 6. NMV F52073, $\times 0.9$. Fig. 8. Dry syntype, BMNH 1886.12.15.261, $\times 0.41$. Fig. 9. NMV F52074, $\times 0.93$. Fig. 11. NMV F52075, $\times 0.56$.

Fig. 10. *Aplysina ianthelliformis* (Lendenfeld). NMV F52070, $\times 0.32$.

Fig. 12. *Druinella rotunda* Lendenfeld. NMV F52078, before preservation, $\times 0.39$.

Plate 18

Perpendicular sections.

Fig. 1. *Corticium candelabrum* Schmidt, NMV F51928, $\times 29$. Surface above.

Figs 2, 3. *Ancorina geodides* Carter, NMV F51929, $\times 29$. Fig. 2. Peripheral choanosome with crypts, part of inner cortex (above). Fig. 3. Inner cortex with chones.

Figs 4-6. *Ancorina repens* sp. nov. Holotype, NMV F51930. Fig. 4. Cortex with surface (above), $\times 29$. Fig. 5. Continuation inward from the bottom of Fig. 4, with innermost cortex, zone of crypts, and peripheral choanosome, $\times 0.29$. Fig. 6. Outer cortex (surface above) with chone, $\times 100$.

Plate 19

Perpendicular sections.

Figs 1, 2. *Ancorina repens* sp. nov. Holotype, NMV F51930. Fig. 1. Wall of chone with oxyspherasters. $\times 87$. Fig. 2. Choanosome, $\times 87$.

Fig. 3. *Ancorina robusta* Carter, NMV F51931, cortex and peripheral choanosome, $\times 29$.

Figs 4-6. *Ancorina suina* sp. nov. Holotype, NMV F51034. Cortex and peripheral choanosome, $\times 29$. The surface faces left in Fig. 5, upwards in Fig. 4, of which Fig. 6 is the continuation inwards.

Plate 20

Figs 1-5. Perpendicular sections through surface, cortex and peripheral choanosome, $\times 29$.

Fig. 1. *Rhabdastrella cordata*, sp. nov. Holotype, NMV F51935.

Fig. 2. *Rhabdastrella intermedia* sp. nov. Holotype, NMV F51936.

Figs 3, 4. *Geodia punctata* Hentschel, NMV F51937. Fig. 3. Solid cortex. Fig. 4. Lacunose cortex.

Figs 5, 6. *Jaspis stellifera* (Carter), NMV F51938. Fig. 5. Surface facing left. Fig. 6. Dissociated megascleres, $\times 87$.

Plate 21

Transverse sections, $\times 0.29$.

Fig. 1. *Tetilla praecipua* sp. nov. Holotype, NMV F51943, choanosome.

Fig. 2. *Tethya ingalli* Bowerbank, NMV F51944, cortex.

Figs 3-5. *Polymastia crassa* Carter. Figs 3, 4. Cortex and peripheral choanosome of main body. Fig. 3. NMV F51945. Fig. 4. NMV F51946. Fig. 5. Wall of fistule in NMV F51946.

Fig. 6. *Spirastrella papillosa* Ridley and Dendy. NMV F51948, peripheral choanosome and inner part of cortex (left).

Plate 22

Transverse sections.

Fig. 1. *Chondrosia reticulata* (Carter). NMV F51951, lower cortex (left) with crypt and peripheral choanosome, $\times 87$. Note pervasive microsymbionts and digitate alga on left side of lower sand grain.

Figs 2, 3. *Latrunculia conulosa* Hallmann. Cortex and peripheral choanosome, $\times 29$. Fig. 2. NMV F51953. Fig. 3. NMV F51952.

Figs 4, 5. *Latrunculia hallmanni* sp. n. Paratype, NMV F51956. Fig. 4. Cortex and peripheral choanosome, $\times 29$. Fig. 5. Peripheral choanosome, chiefly with small, irregular sandasters, $\times 87$. A small portion of the cortex is visible above.

Fig. 6. *Pseudaxinella decipiens* sp. nov. Holotype, NMV F51961, choanosome, $\times 29$.

Plate 23

Transverse sections, $\times 29$.

Fig. 1. *Reniochalina sectilis* sp. nov. Holotype, NMV F51962. Ectosomal skeleton (upper half) and main skeleton.

Fig. 2. *Rhaphoxya cactiformis* (Carter). NMV F51963, mesial skeleton.

Figs 3, 4. *Rhaphoxya felina* sp. nov. Holotype, NMV F51964. Fig. 3. Choanosome. Fig. 4. Erect lamella at surface with chiefly penicillate arrangement of megascleres.

Fig. 5. *Clathriodendron cacticutis* (Carter). NMV F51966, mesial choanosome.

Fig. 6. *Clathria transiens* Hallmann. NMV F51980, peripheral choanosome.

Plate 24

Fig. 1. *Clathria wilsoni* sp. nov. Holotype, NMV F51967, peripheral choanosome, $\times 29$. The surface with the paratangential open penicils is folded over into the plane of the section in the left half.

Fig. 2. *Echinoclathria favus* Carter. NMV F51972, transverse section through lamella, $\times 29$.

Fig. 3. *Phoriospongia reticulum* Marshall. Holotype, ZMB 2634. Teased portion of choanosome, $\times 87$, showing arrangement of sigmata.

Figs 4, 5. *Echinoclathria leporina* (Lamarck). Transverse sections through fronds, $\times 29$. Fig. 4. NMV F51974. Fig. 5. NMV F51973, apical edge.

Fig. 6. *Echinoclathria egena* sp. nov. Holotype, NMV F51978. Peripheral choanosome with embryos, surface on top, $\times 29$.

Plate 25

Transverse sections

Figs 1, 2. *Echinoclathria egena* sp.nov. Holotype, NMV F51978. Fig. 1. Deeper choanosome, $\times 29$. Fig. 2. Peripheral choanosome with surface in upper right, $\times 87$.

Figs 3, 4. *Echinoclathria tubulosa* (Hallmann). NMV F51979, $\times 29$. Fig. 3. Deeper choanosome. Fig. 4. Peripheral choanosome.

Figs 5, 6. *Strongylacidon stelliderma* (Carter). NMV F51981, $\times 29$. Fig. 5. Deeper choanosome. Fig. 6. Peripheral choanosome with conules.

Plate 26

Transverse sections

Figs 1–4. *Stylotella inaequalis* (Hentschel). Fig. 1. NMV F51984, mixed skeletal structure, single sand grains, macrosymbionts, $\times 29$. Fig. 2. NMV F51983, sandy enclaves, scarce spicular whips, $\times 29$. Fig. 3. NMV F51987, dense skeletal structure, $\times 29$. Fig. 4. NMV F51987, surface with paratangential layer of megascleres, $\times 87$.

Fig. 5. *Phoriospongia argentea* (Marshall), NMV F51989, $\times 29$. Note small single tallophytous alga below surface.

Fig. 6. *Phoriospongia carcinophila* (Lendenfeld), NMV F51992, $\times 29$.

Plate 27

Transverse sections with ectosome, $\times 29$.

Figs 1, 2. *Phoriospongia carcinophila* (Lendenfeld). Fig. 1. NMV F51991. Fig. 2. NMV F51990. Note the felt of proper spicules at and below the surface.

Fig. 3. *Psammoclema bitextum* sp. nov. Holotype, NMV F51996.

Fig. 4. *Psammoclema callosum* (Marshall). NMV F51997.

Fig. 5. *Psammoclema densum* (Marshall). NMV F51998. Note the crowded foreign spicule fragments at the surface.

Fig. 6. *Psammoclema nodosum* (Carter). NMV F52003. Note infolded ectosome (upper right), lined canal (lower center), ascending column with detritus, and algal filaments (lower right).

Plate 28

Figs 1, 2. *Psammoclema goniodes* sp.nov. Transverse sections, $\times 29$. Fig. 1. Paratype, NMV F52059 (surface above). Fig. 2. Holotype, NMV F52060. Surface upper right.

Figs 3, 4. *Psammoclema ramosum* Marshall. NMV F52005, $\times 29$. Fig. 3. Longitudinal section, surface left. Fig. 4. Transverse section.

Fig. 5. *Psammoclema stipitatum* sp.nov. Holotype, NMV F52006, choanosome, transverse section, $\times 29$.

Fig. 6. *Psammoclema vansoesti* sp.nov. Paratype, NMV F52007, transverse section with surface, $\times 29$.

Plate 29

Figs 1–4. *Mycale (Arenochalina) mirabilis* Lendenfeld. Fig. 1. NMV F52014, peripheral skeleton (surface above), $\times 29$. Fig. 2. Junction of secondary and primary fibre, $\times 87$. Note stratification, filamentous algae in primary

fibre, and the transverse spicules protruding from the latter, with partial spongin envelopes. Fig. 3. Tapering free end of primary fibre at surface, $\times 29$. Fig. 4. Filamentous algae in primary fibre, $\times 87$.

Figs 5, 6. *Tedania anhelans* (Lieberkühn), perpendicular sections. Fig. 5. NMV F52010, $\times 29$ (surface on top). Fig. 6. NMV F52009, $\times 29$ (surface in upper left corner).

Plate 30

Fig. 1. *Tedania anhelans* (Lieberkühn). NMV F51940, Transverse section with surface, $\times 29$.

Fig. 2. *Forcepia biceps* (Carter). NMV F52018, transverse section, $\times 29$. Ectosome on top with megascleres in paratangential arrangement, in oblique view.

Fig. 3. *Lissodendoryx isodictyalis* (Carter). NMV F52019, transverse section with surface, $\times 29$.

Fig. 4. *Phorbas* cf. *tenacior* (Topsent). NMV F52022, transverse section with surface, $\times 29$.

Fig. 5. *Ectyodoryx maculata* Hentschel. NMV F52020, deeper choanosome, $\times 29$.

Plate 31

Fig. 1. *Ectyodoryx maculata* Hentschel. NMV F52020, perpendicular section through peripheral choanosome and ectosome, $\times 29$.

Figs 2, 3. *Callyspongia asparagus* (Lamarck), NMV F52024. Fig. 2. Perpendicular section with ectosome, $\times 29$. Fig. 3. Tangential section of ectosome, $\times 29$.

Figs 4, 5. *Callyspongia diffusa* (Ridley and Dendy), NMV F52026. Fig. 4. Tangential section of ectosome, $\times 29$. Fig. 5. Perpendicular section with ectosome, $\times 29$.

Fig. 6. *Callyspongia pergamentacea* (Ridley). NMV F52027, perpendicular section with ectosome, $\times 29$.

Plate 32

Fig. 1. *Callyspongia pergamentacea* (Ridley). NMV F52027. Ectosome, Tangential section, $\times 29$.

Figs 2–4. *Callyspongia serpentina* (Lamarck). NMV F52029, perpendicular sections with ectosome. Fig. 2. $\times 29$. Fig. 3. $\times 82$. Fig. 4. $\times 87$.

Figs 5, 6. *Callyspongia toxifera* sp.nov., paratypes, transverse sections with ectosome, $\times 29$. Fig. 5. NMV F52030. Fig. 6. NMV F52031.

Plate 33

Figs 1–3. *Callyspongia persculpta* sp.nov. Holotype, NMV F52035, $\times 29$. Fig. 1. Ectosome, tangential section. Figs 2, 3. Transverse sections with ectosome. Fig. 3 shows the edge of one of the hollow lobes.

Figs 4–6. *Gelliodes incrustans* Dendy, NMV F52036, transverse sections. Figs 4, 5. Ectosome on top, $\times 29$. Fig. 6. Deeper choanosome, $\times 87$.

Plate 34

Fig. 1. *Gelliodes incrustans* Dendy. NMV F52036, deeper choanosome, $\times 87$.

Fig. 2. *Spongia hispida* Lamarck. NMV F52039, transverse section with ectosome, $\times 29$.

Fig. 3. *Carteriospongia caliciformis* Carter. NMV F52040a, transverse section with ectosome, $\times 29$.

Fig. 4. *Carteriospongia* cf. *vermicularis* (Lendenfeld). NMV F52041, transverse section with ectosome. $\times 29$.

Figs 5, 6. *Ircinia caliculata* Lendenfeld. NMV F52049. Fig. 5. Transverse section with choanosome, $\times 29$. Fig. 6. Choanosome with filaments. Inflated ends of the latter are visible near the upper left corner and halfway down near the right margin.

Plate 35

Figs 1, 2. *Thorecta choanoides* (Bowerbank). NMV F52050, $\times 29$. Fig. 1. Transverse section through ectosome and peripheral choanosome, the former with transition from a superficial elevation (above) to an inhalant depression (below). Fig. 2. Sieve of inhalant depression in ectosome.

Figs 3–5. *Thorecta tuberculatus* (Carter). Transverse sections. Fig. 3. NMV F52054, ectosome and peripheral choanosome, $\times 29$. Figs 4, 5. NMV F52053. Fig. 4. Peripheral choanosome, $\times 29$. Fig. 5. Fibrous-stratified zone between sandy ectosome and choanosome, $\times 87$.

Fig. 6. *Dysidea avara* (Schmidt). NMV F52057, choanosome with fibre, $\times 29$.

Plate 36

Transverse sections

Fig. 1. *Darwinella australiensis* Carter. NMV F52064. Choanosome, $\times 29$.

Fig. 2. *Aplysina ianthelliiformis* (Lendenfeld). NMV F52070. Choanosome, $\times 29$.

Figs 3–6. *Aplysina lendenfeldi* Bergquist. Fig. 3. NMV F52072, ectosome and peripheral choanosome, $\times 29$. Fig.

4. NMV 52071, ectosome with inhalant sieve, $\times 29$. Fig. 5. NMV F52071, choanosome with transversely and obliquely cut fibres, $\times 29$. Fig. 6. NMV F52071, fibre, $\times 87$.

Plate 37

Fig. 1. *Aplysina lendenfeldi* Bergquist. NMV F52072, choanosome with gemmules, $\times 87$.

Figs 2–6. *Pseudoceratina durissima* Carter. Fig. 2. NMV F52074, perpendicular section with ectosome (above) and peripheral choanosome, $\times 29$. Note reticulate-septate canal. Fig. 3. NMV F52074, choanosome with transversally cut fibre, $\times 87$. Fig. 4. NMV F52074, crowded choanocyte chambers, $\times 87$. Figs 5, 6. NMV F52075 and F52076, respectively, longitudinal sections of fibres, $\times 87$. Note irregularly lobose, partly composite pith, and, in Fig. 5, density of microsymbionts.

Plate 38

Figs 1–5. *Druinella rotunda* Lendenfeld. ZMB 10403, one of Lendenfeld's slides with microtome sections from the holotype. Fig. 1. Oblique section of fibre, $\times 29$. A transversally cut canal of type 1 is situated near the middle of the upper margin. Fig. 2. Choanosome, $\times 29$, overlapping with the upper margin of Fig. 1. Canals of type 2 chiefly in left half, canals of type 1 in right half. Choanocyte chambers are confined to the darker meandering fields. Figs 3, 4. Transverse sections of fibres, $\times 87$. Fig. 5. Choanosome, $\times 29$.

Fig. 6. *Phoriospongia argentea* (Marshall). NMV F51989, transverse section with ectosome, $\times 29$.

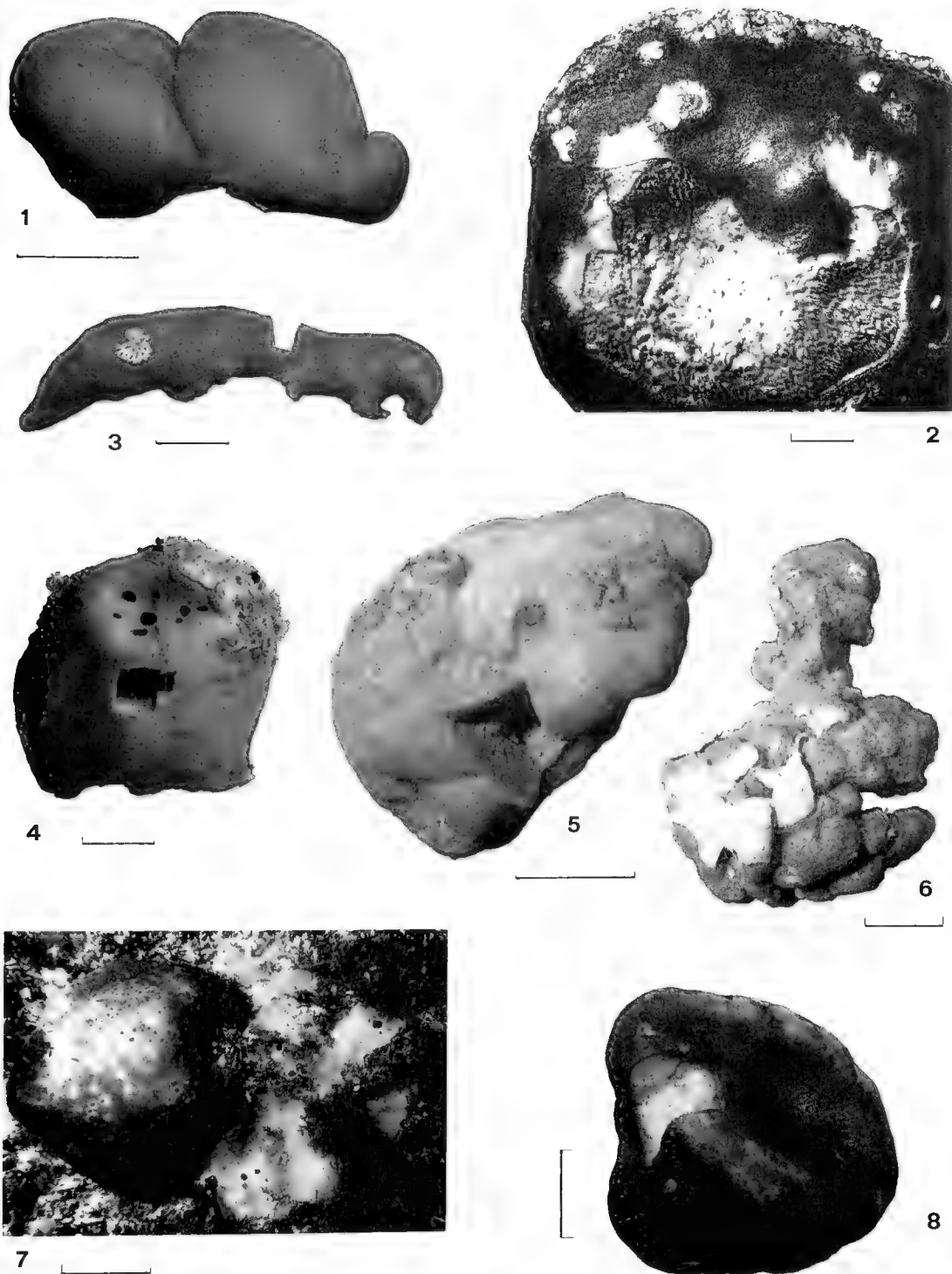


PLATE 1

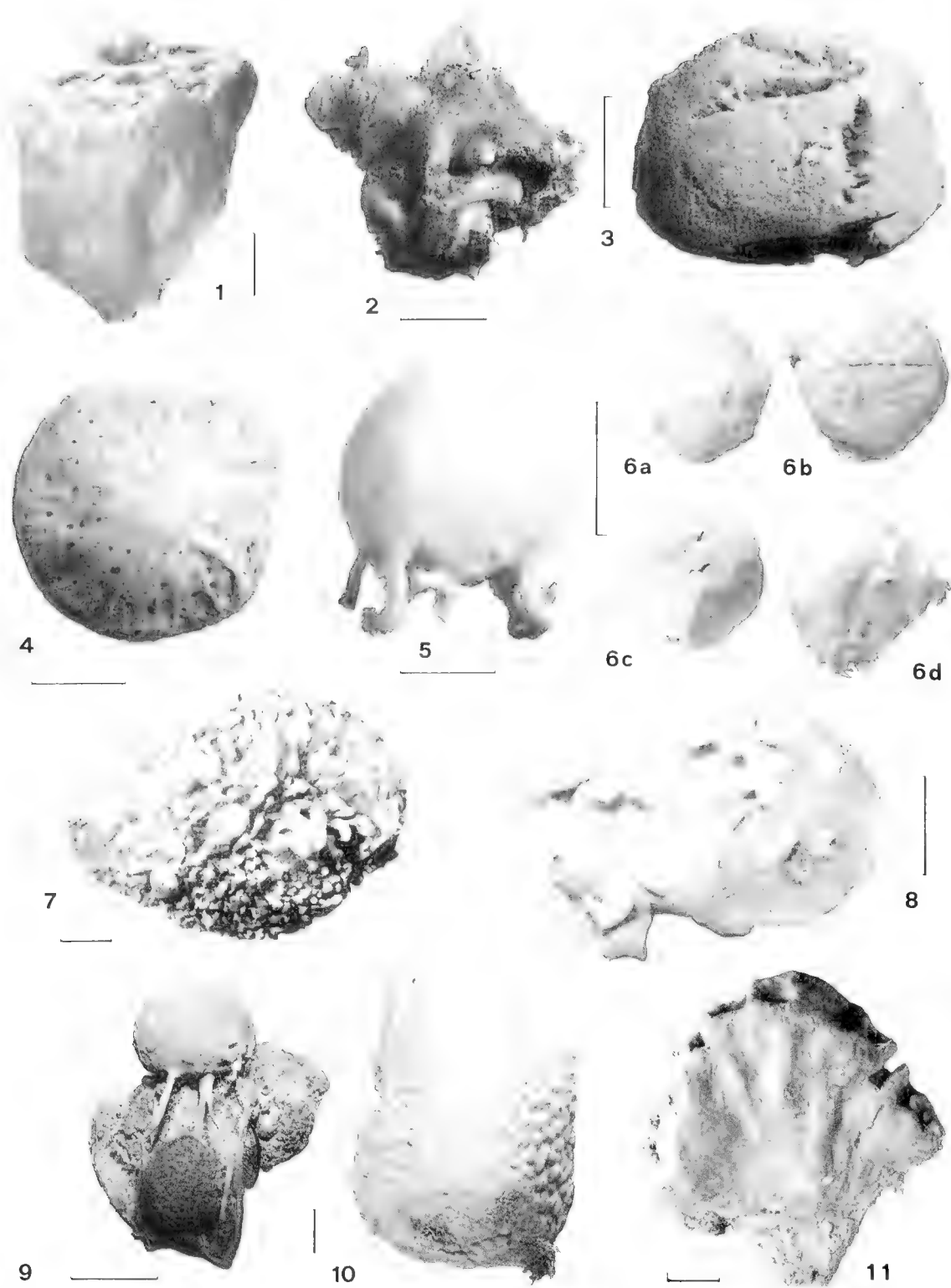


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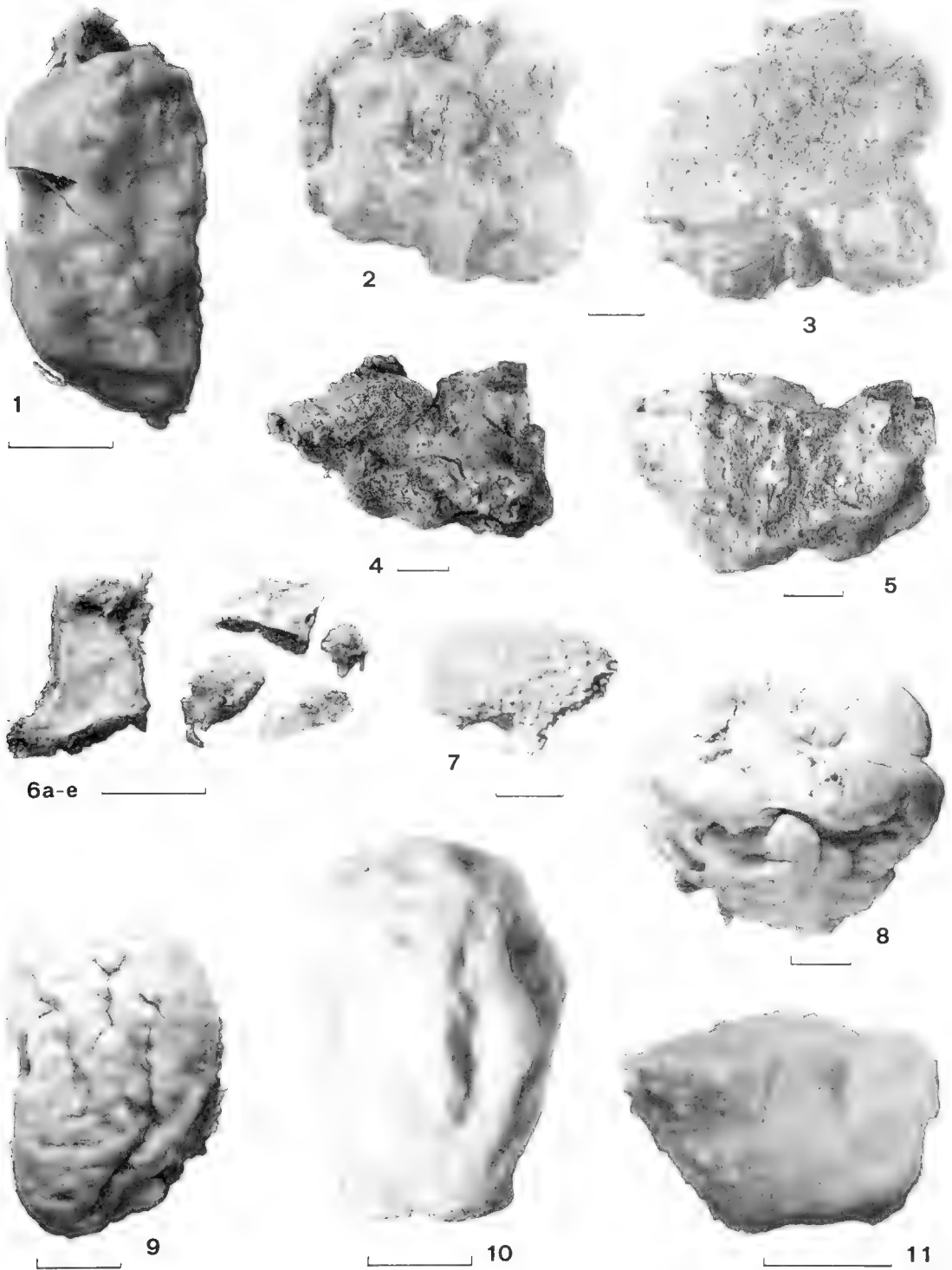


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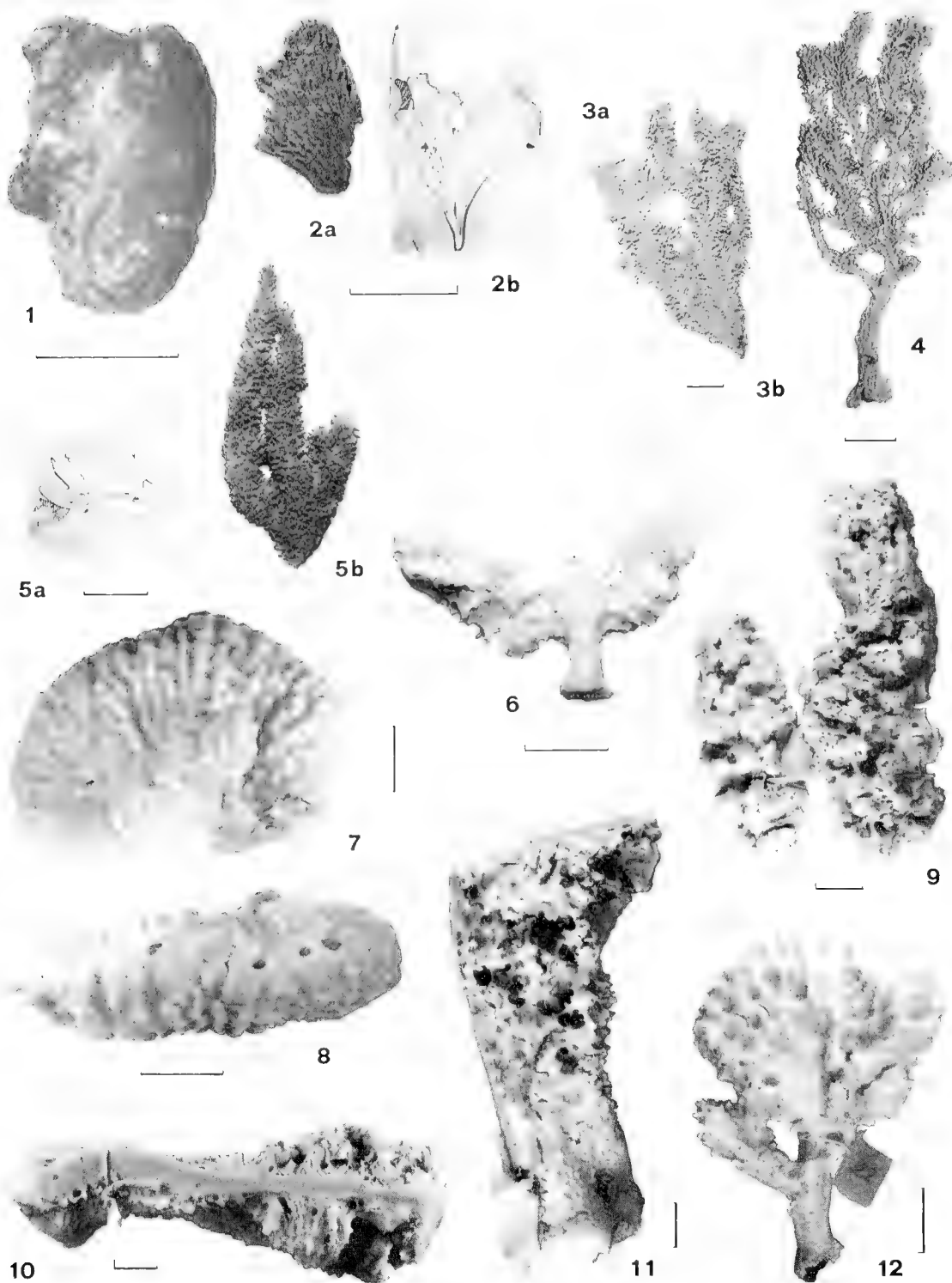


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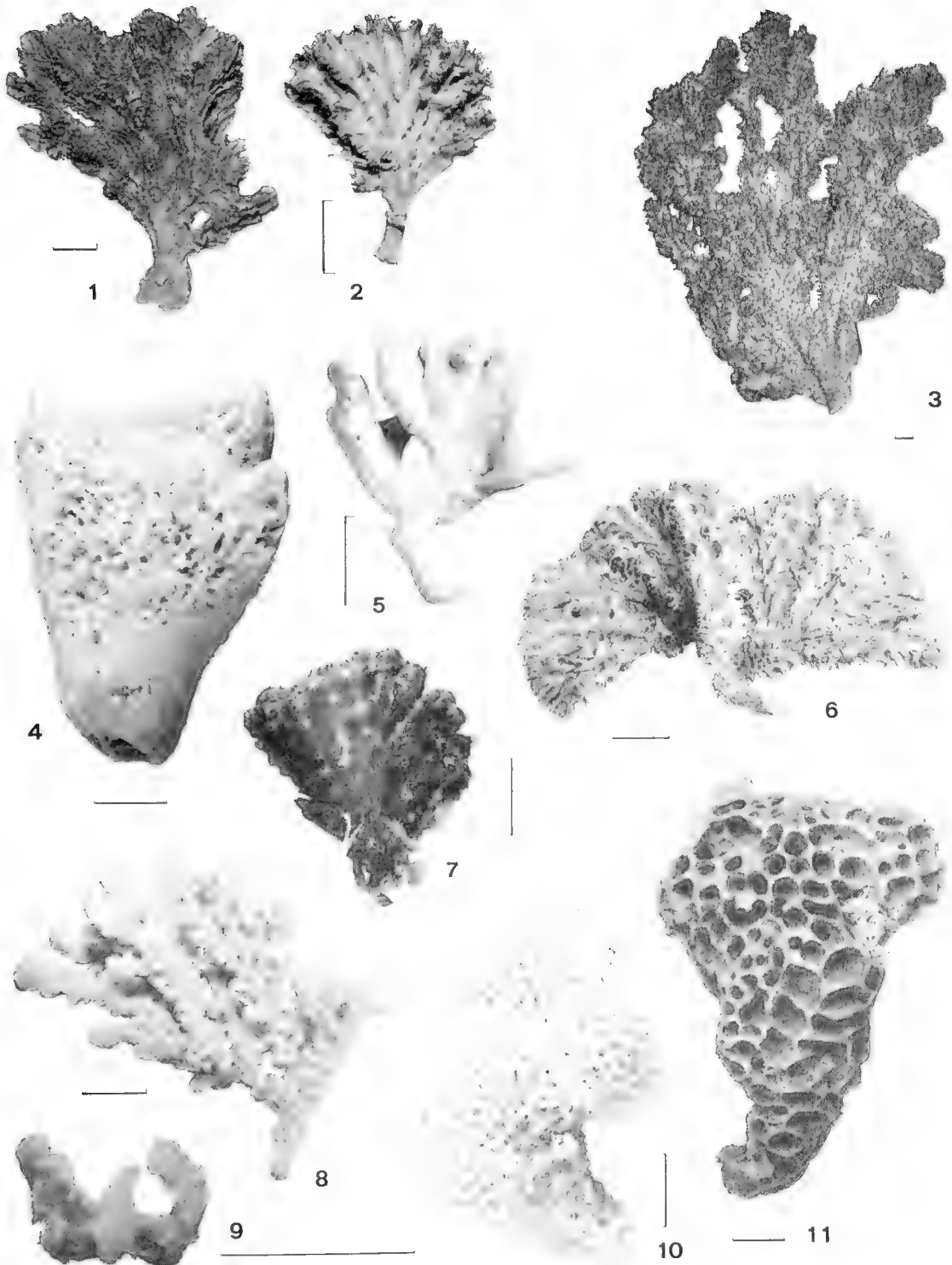
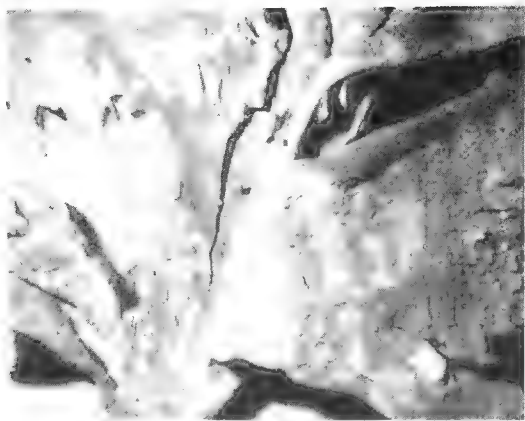
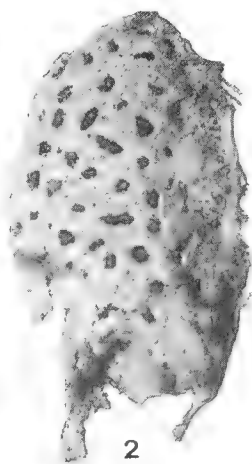


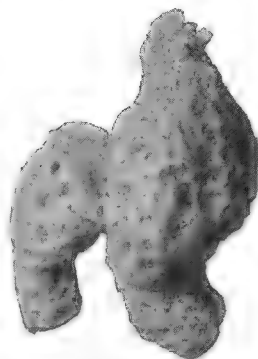
PLATE 5



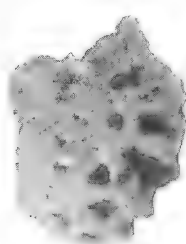
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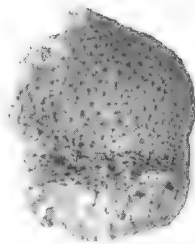
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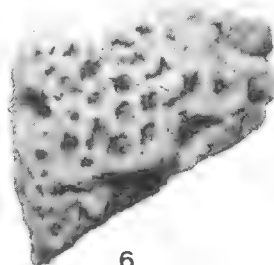
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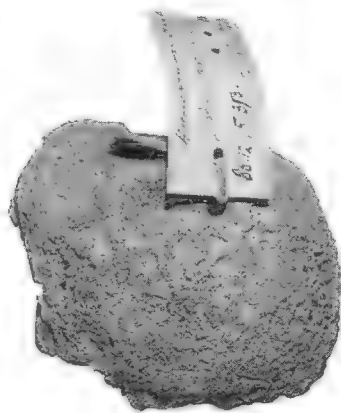
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5



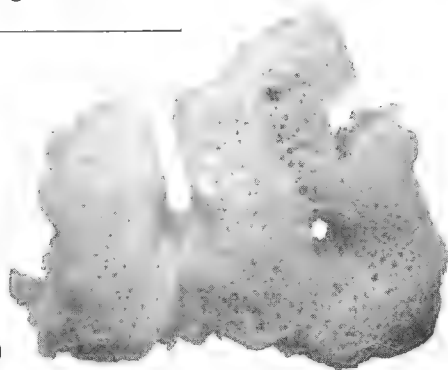
6



7



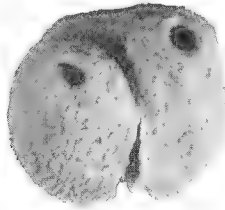
8



9



10



11

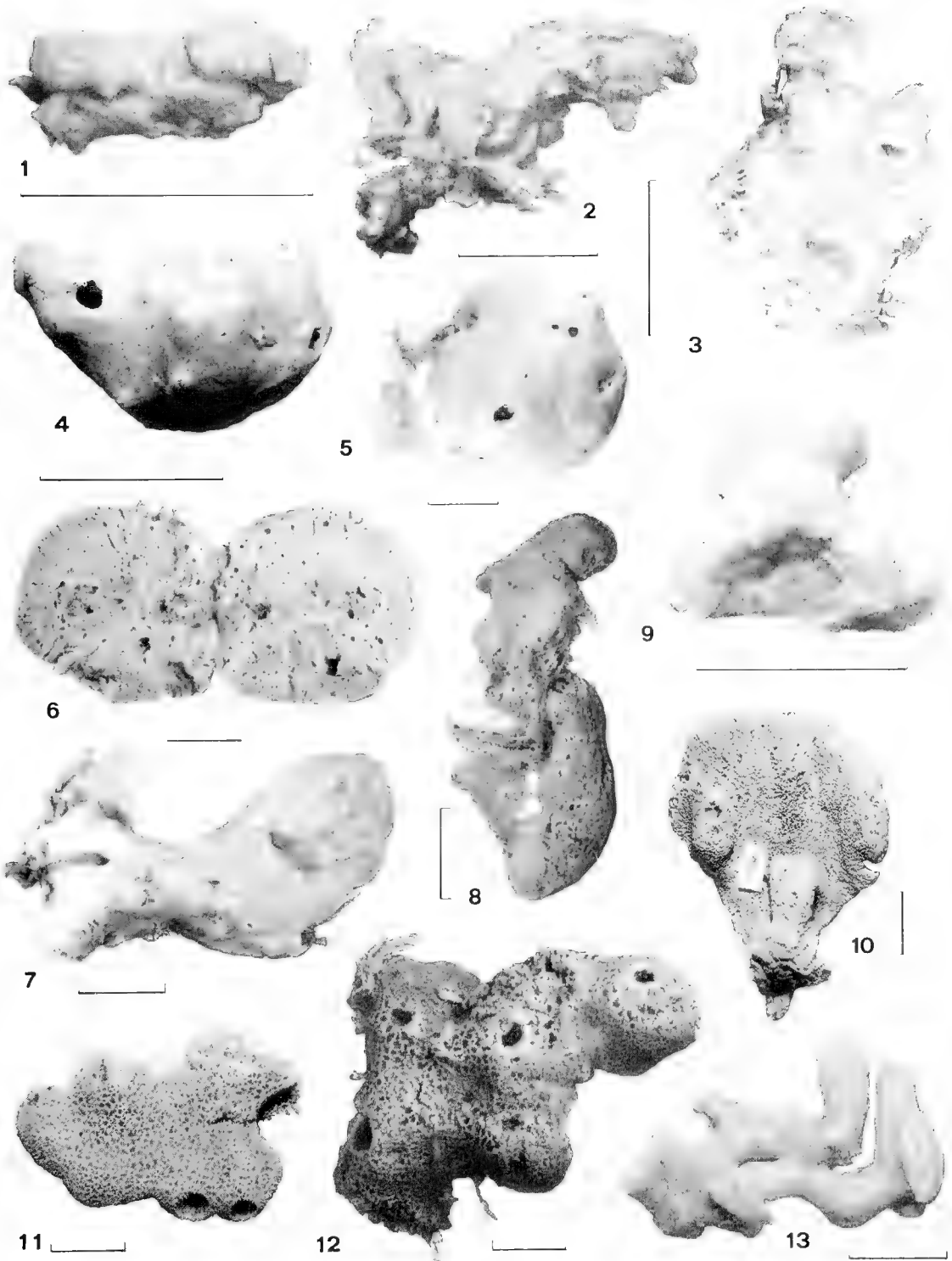


PLATE 7

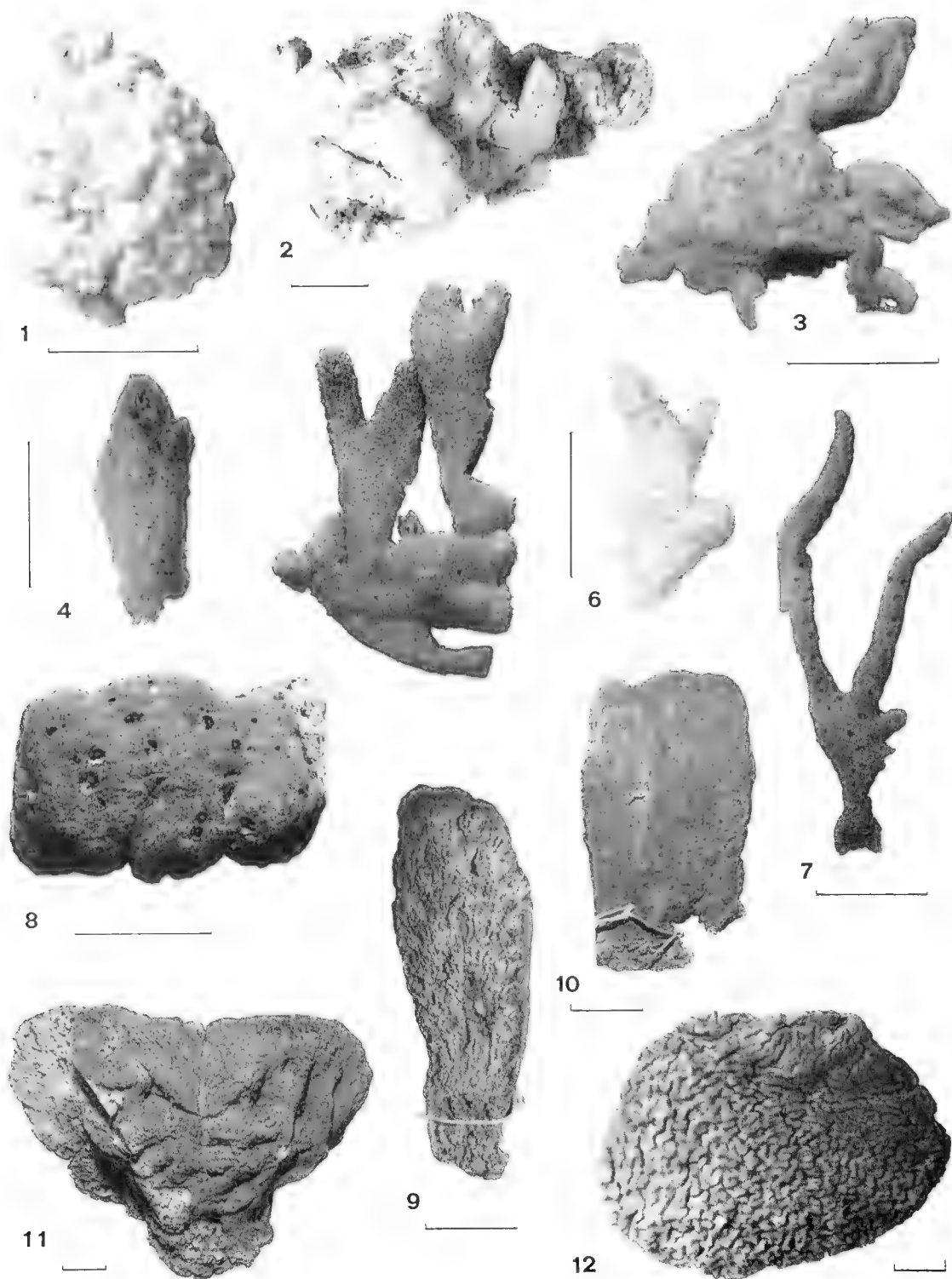


PLATE 8

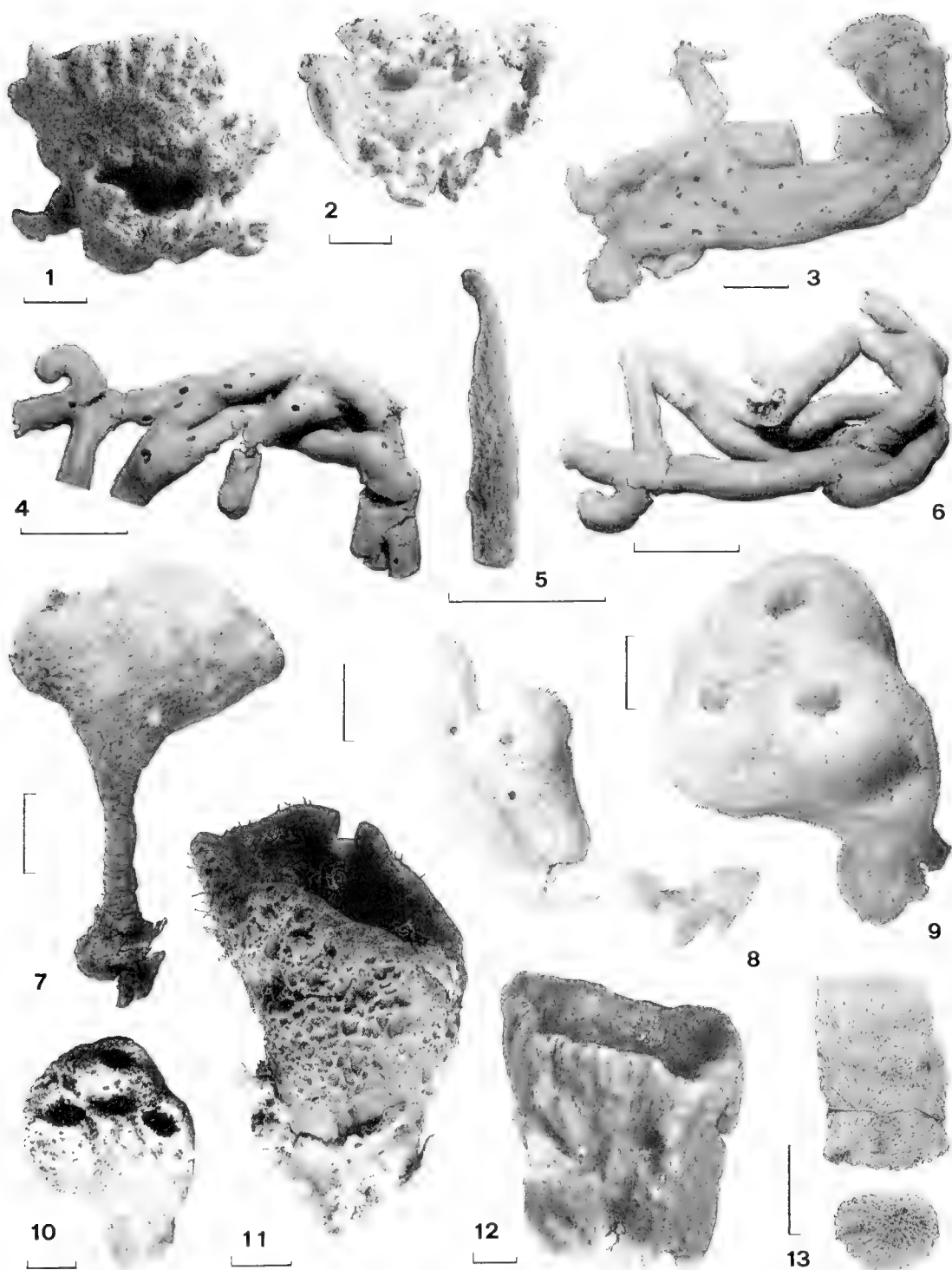


PLATE 9

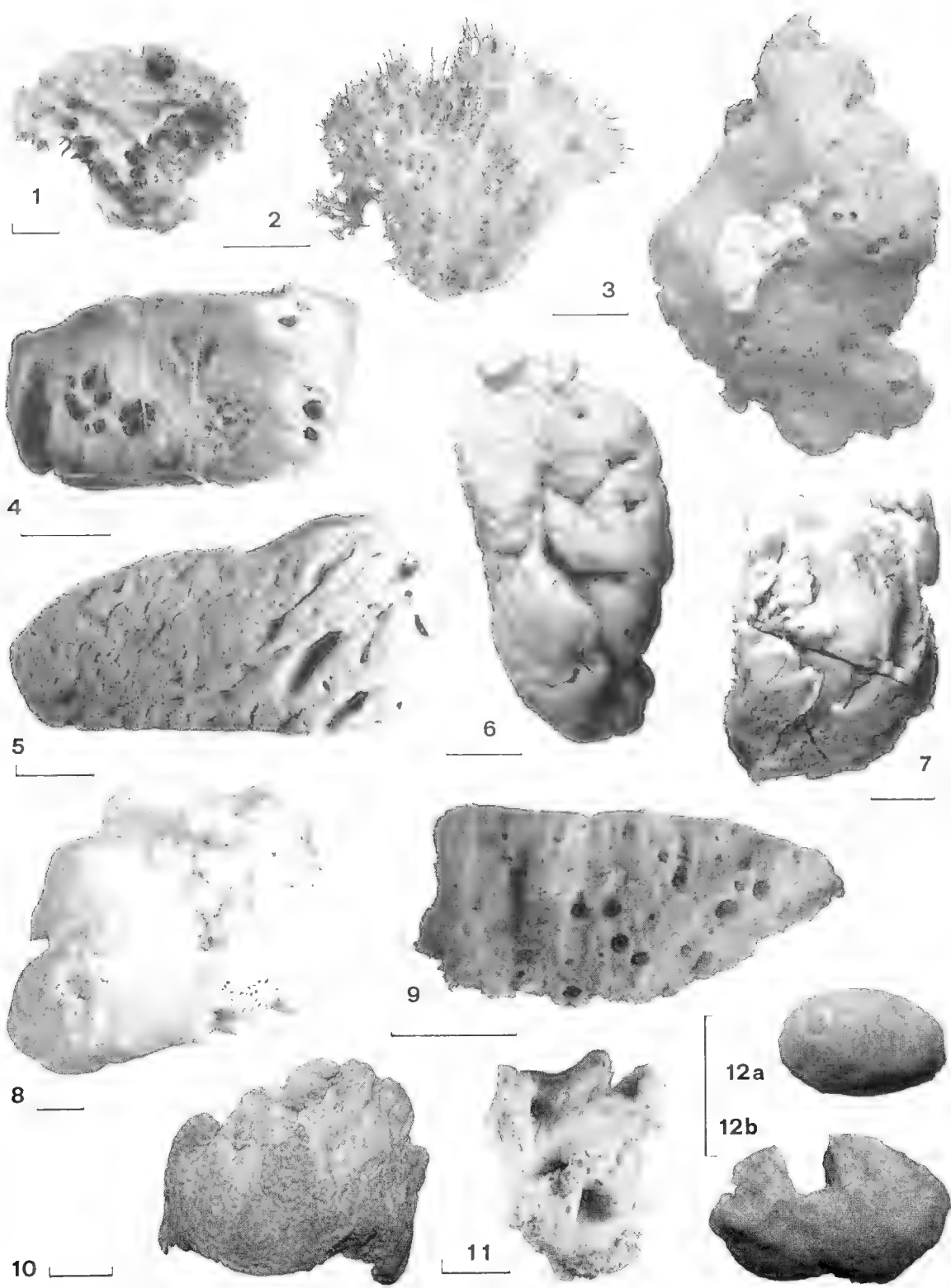


PLATE 10

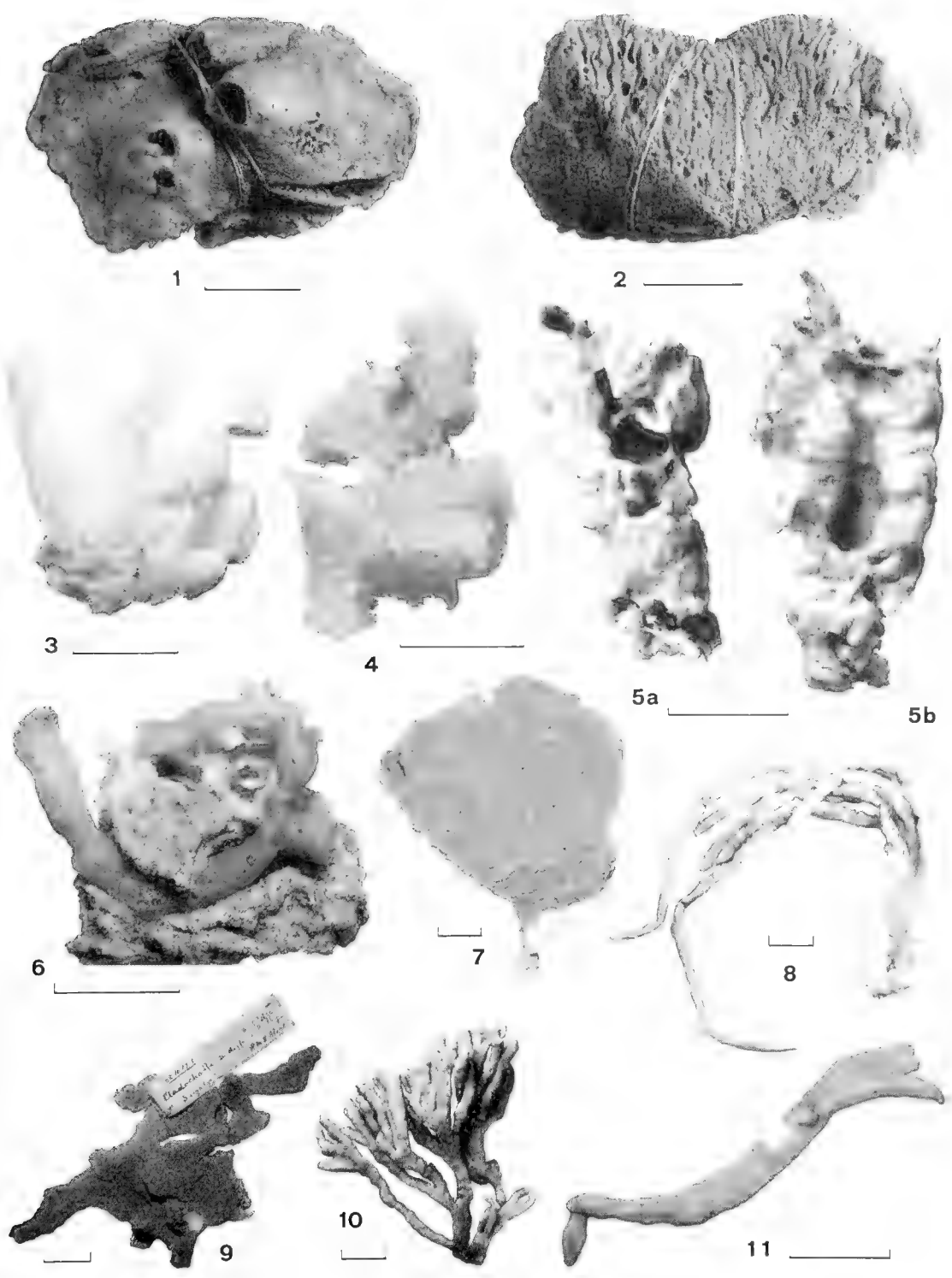


PLATE 11

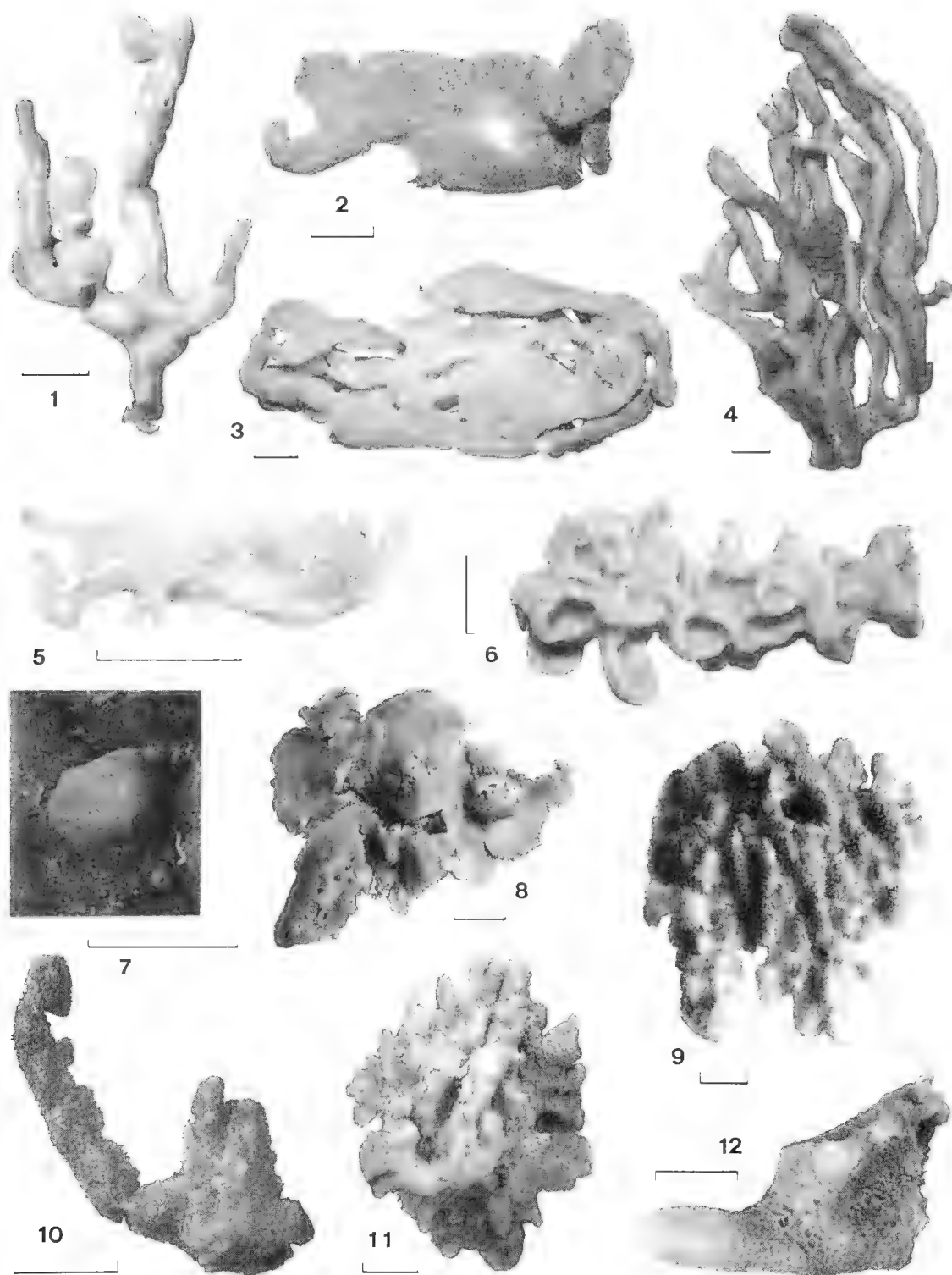


PLATE 12

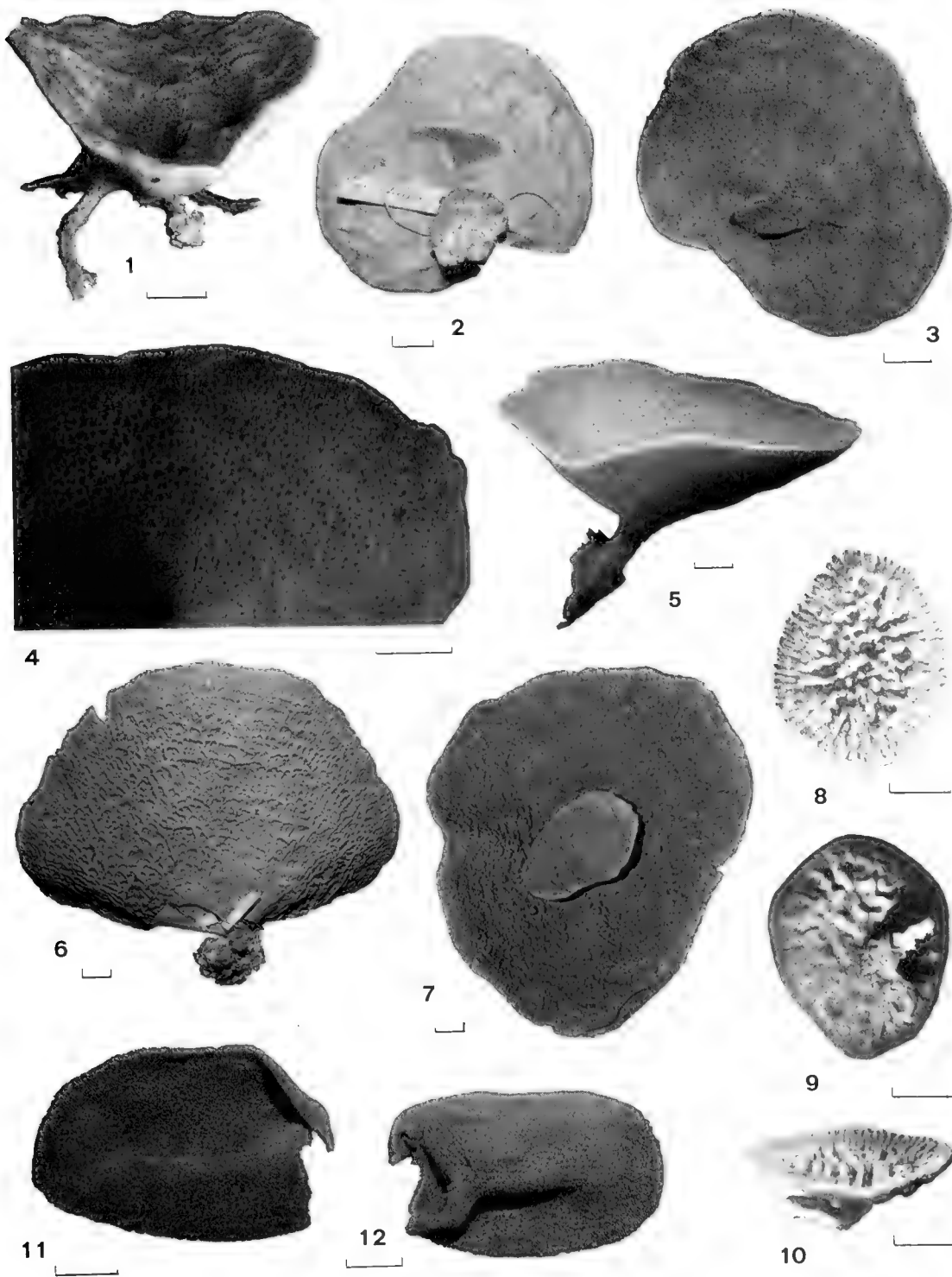


PLATE 13

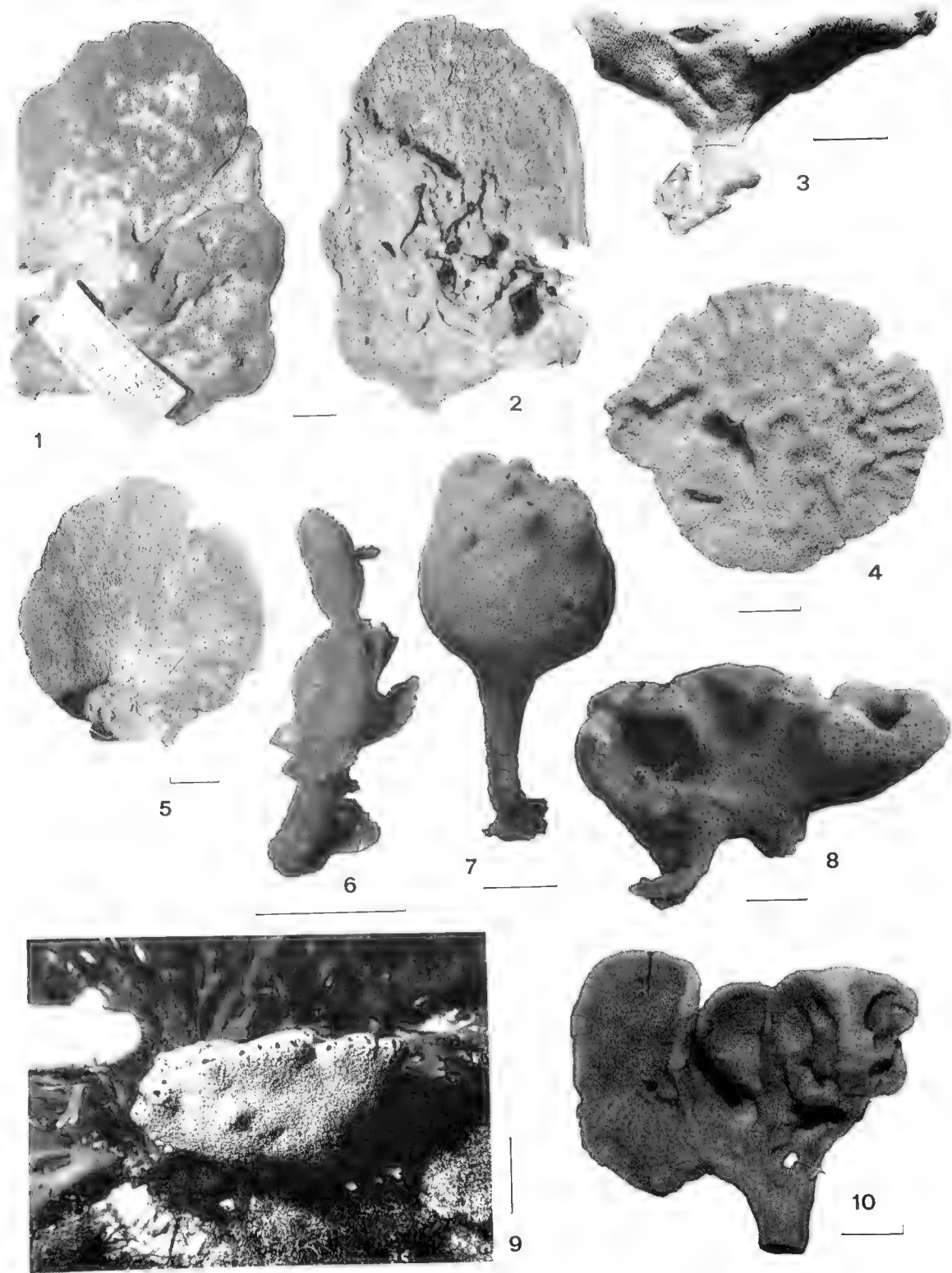


PLATE 14

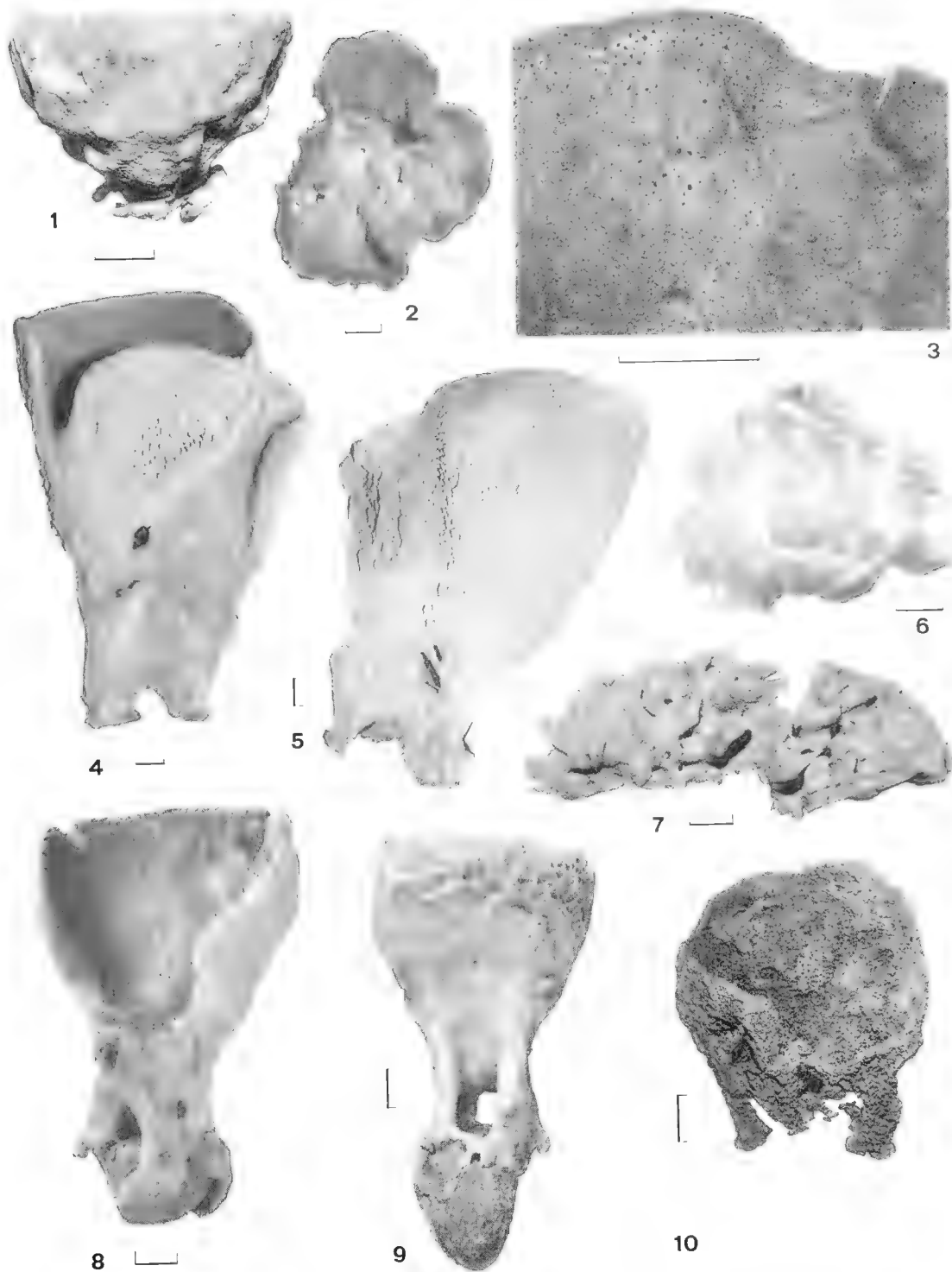


PLATE 15

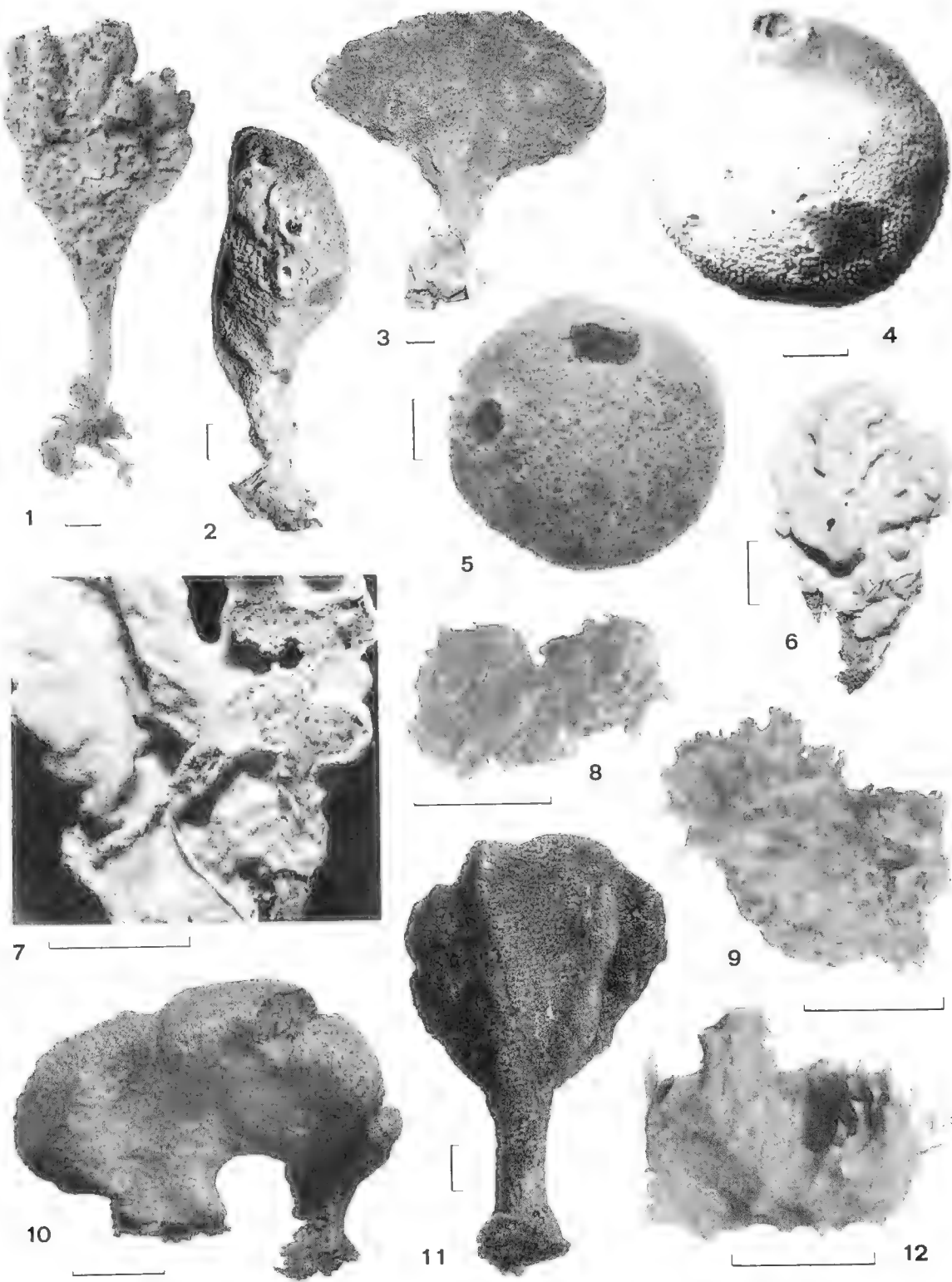


PLATE 16

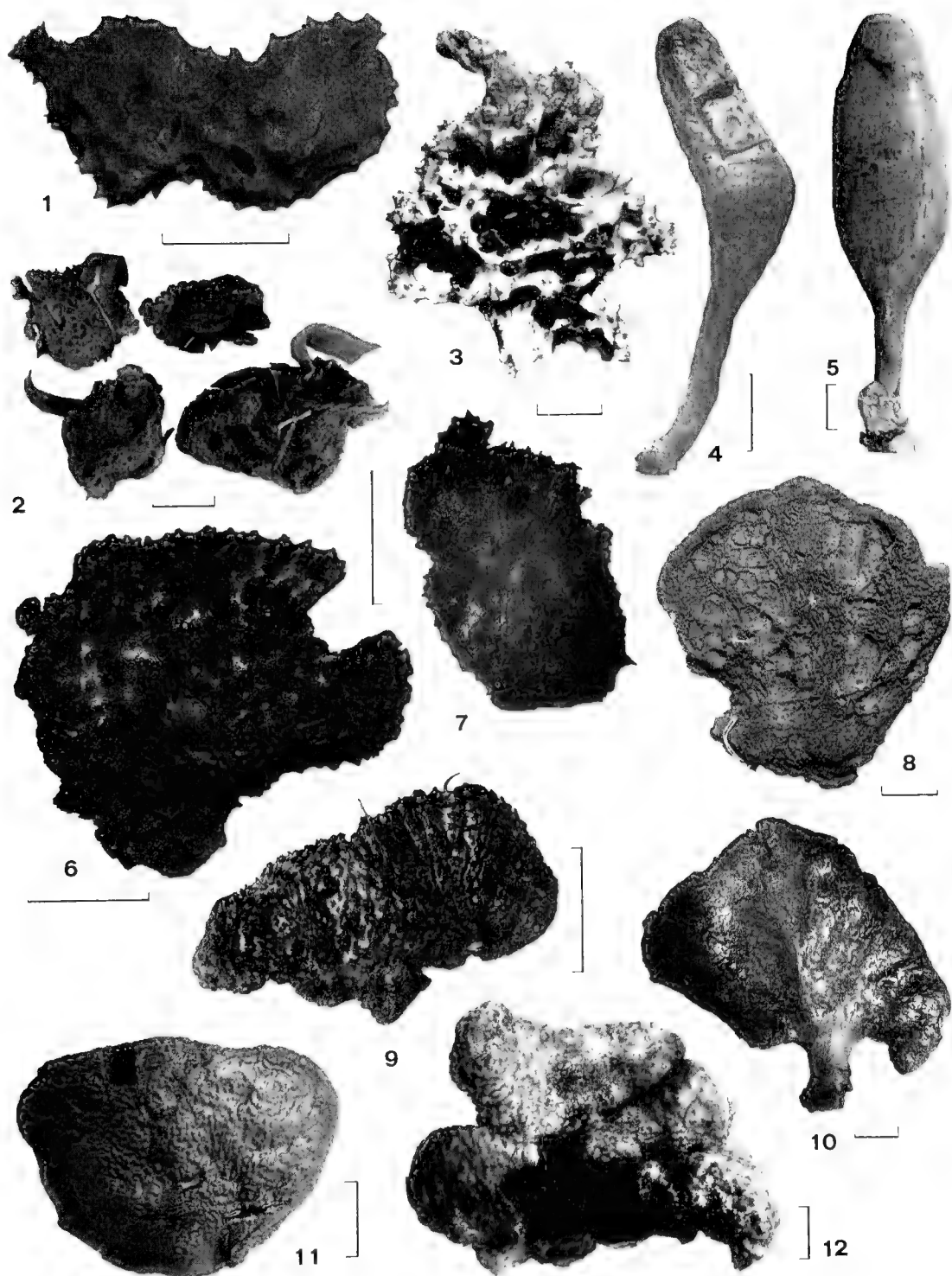
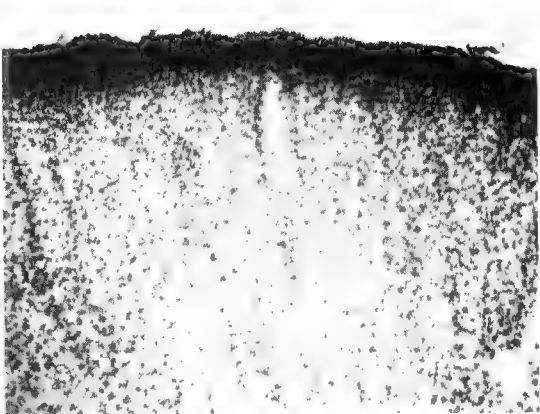
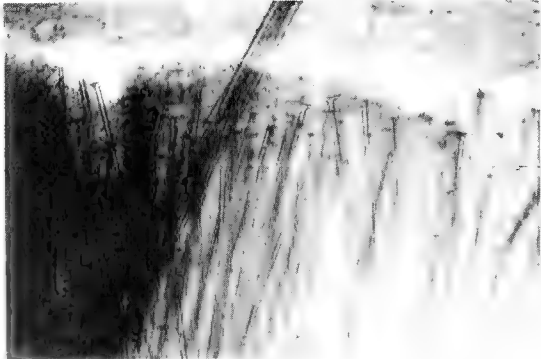


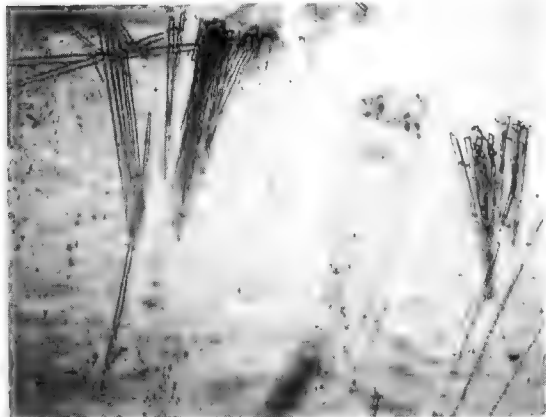
PLATE 17



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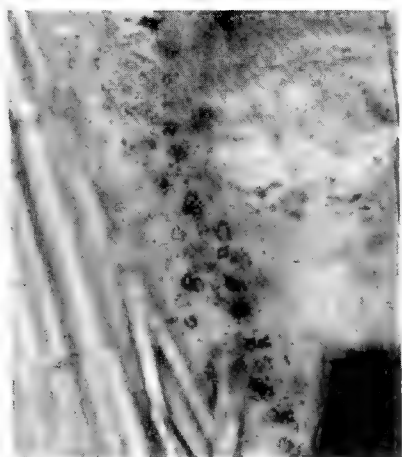
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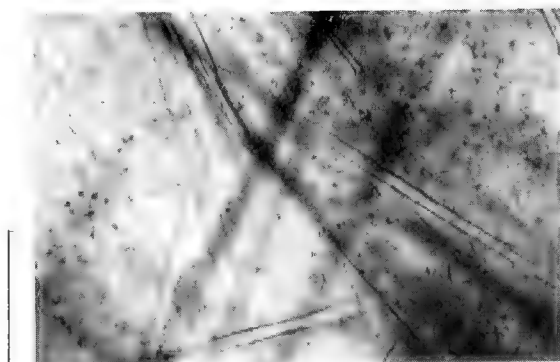
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6



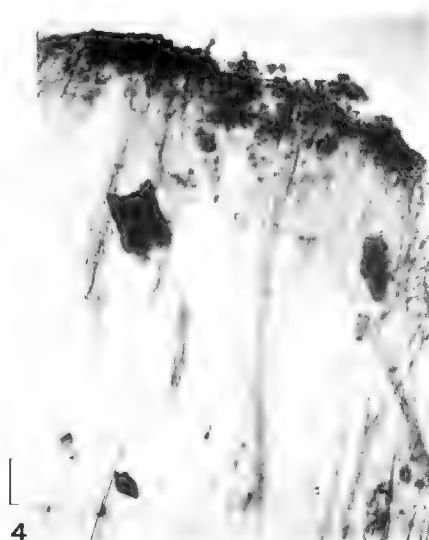
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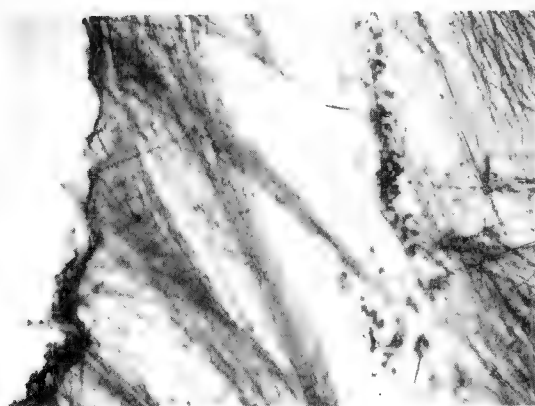
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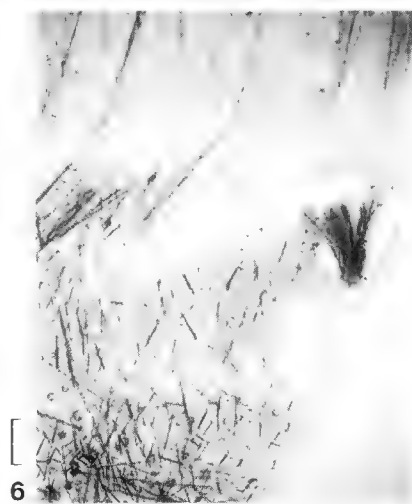
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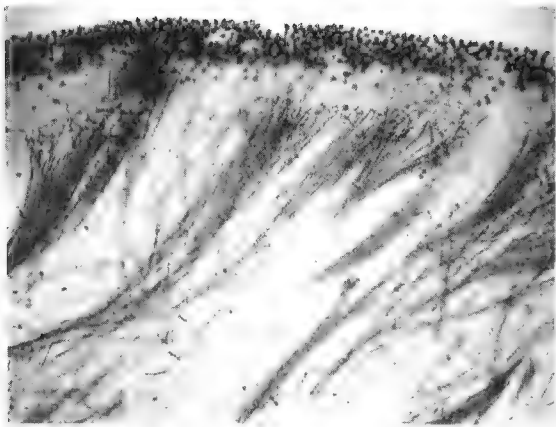
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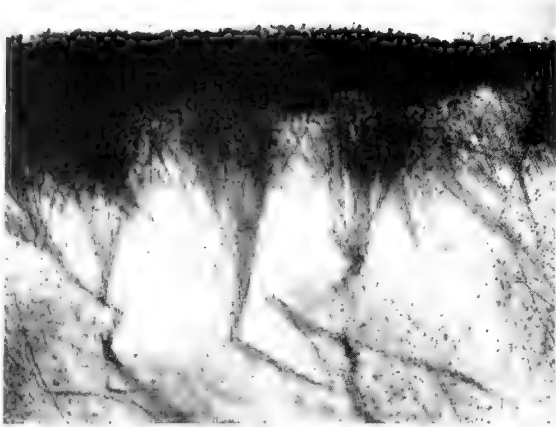
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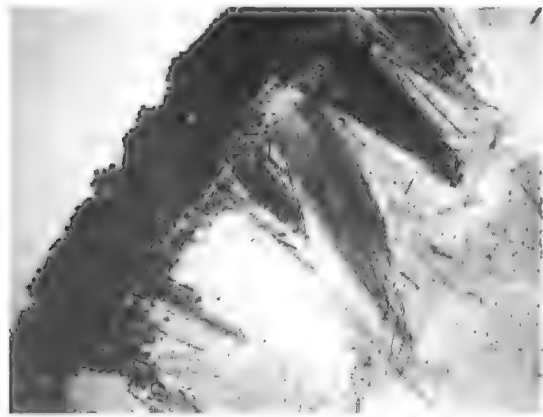
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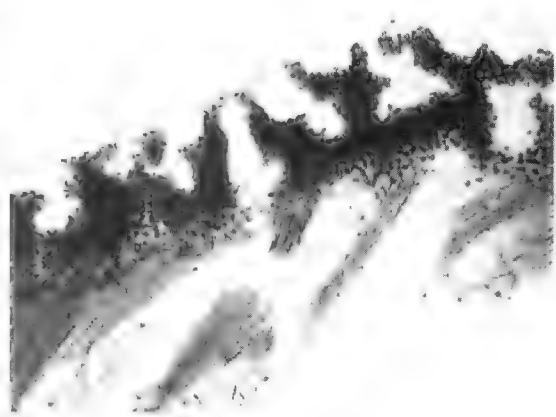
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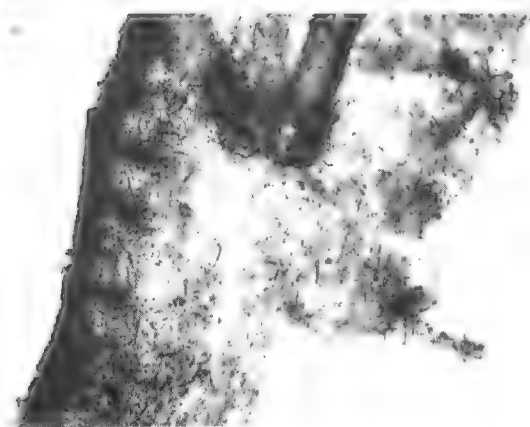
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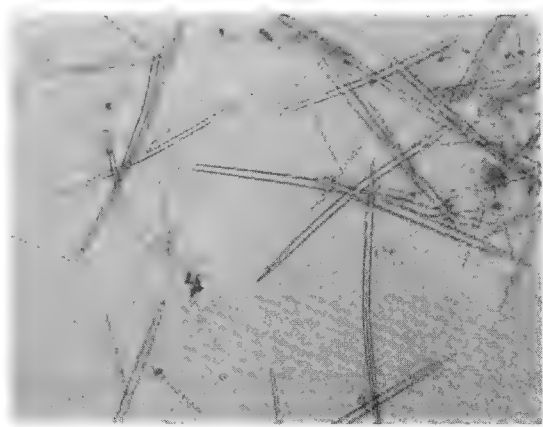
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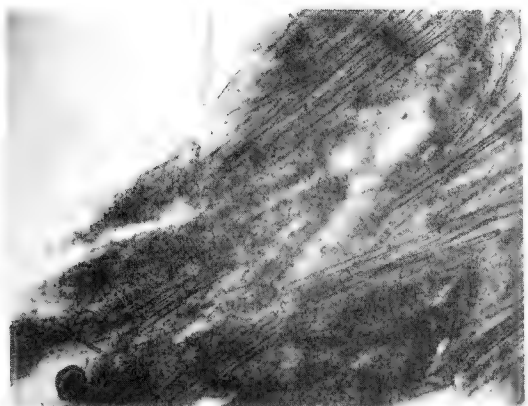
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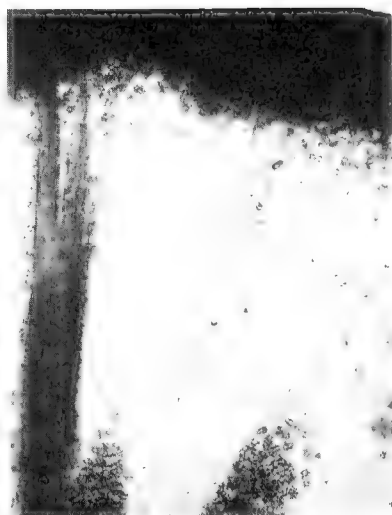
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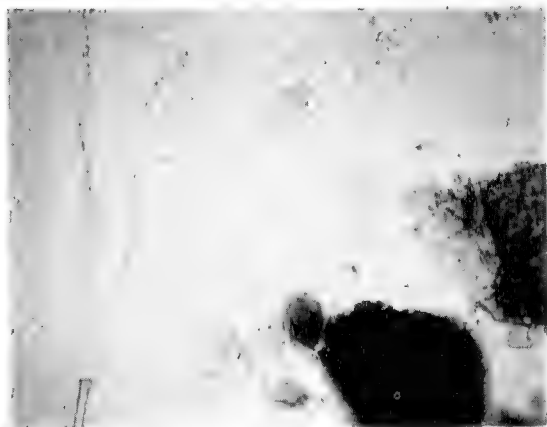
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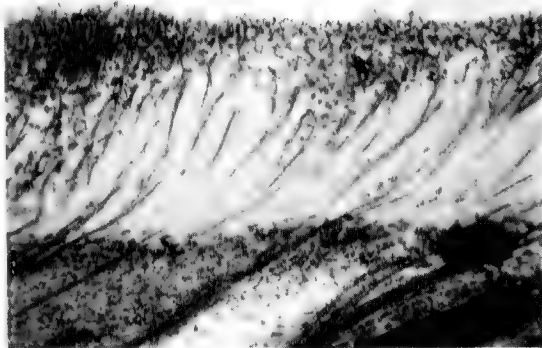
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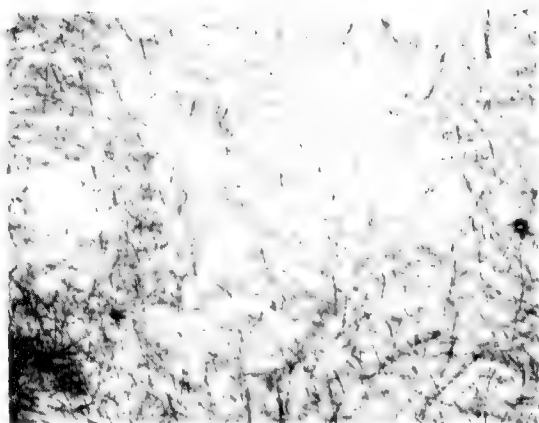
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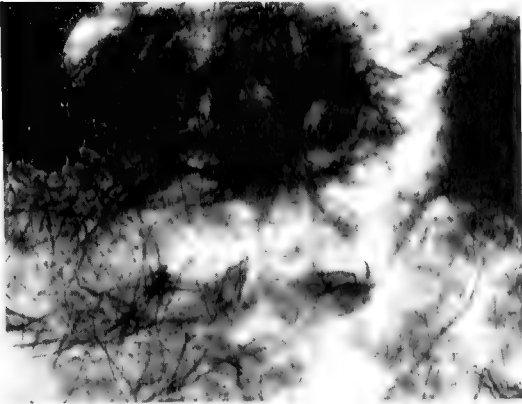
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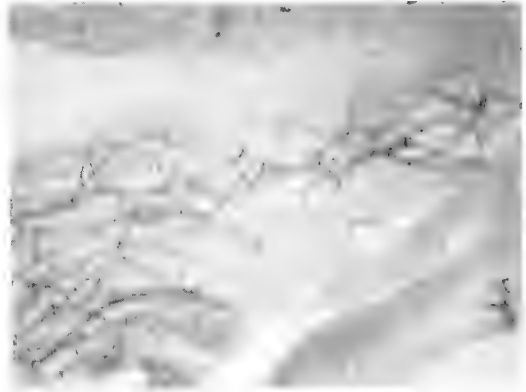
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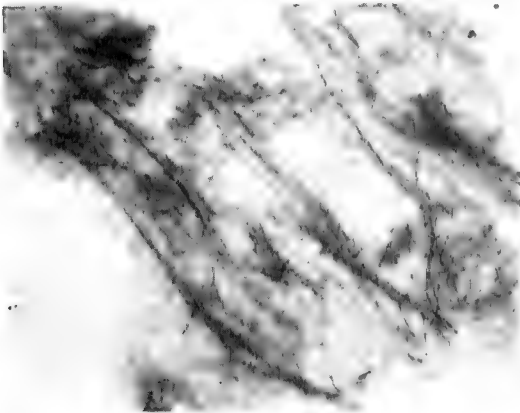
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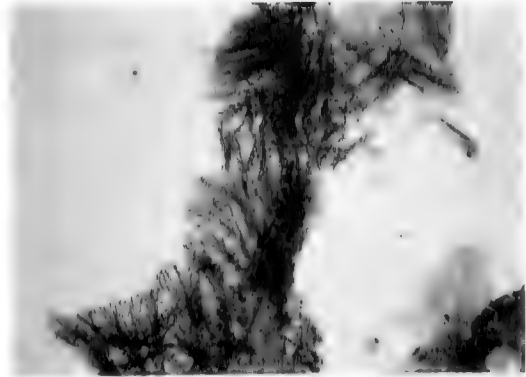
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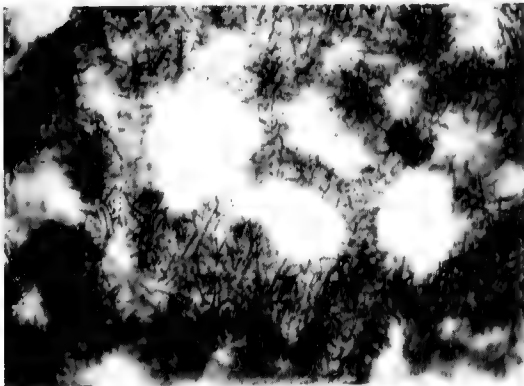
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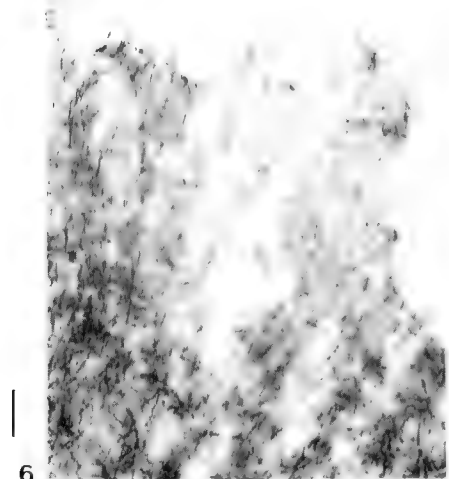
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4



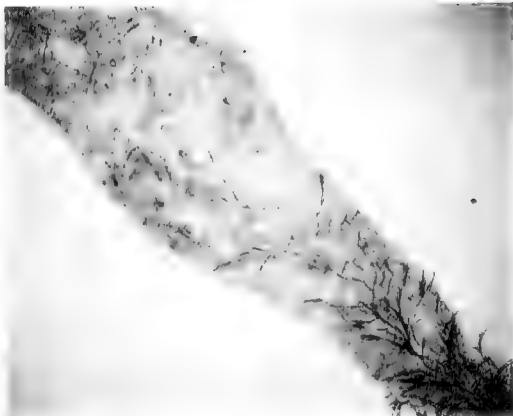
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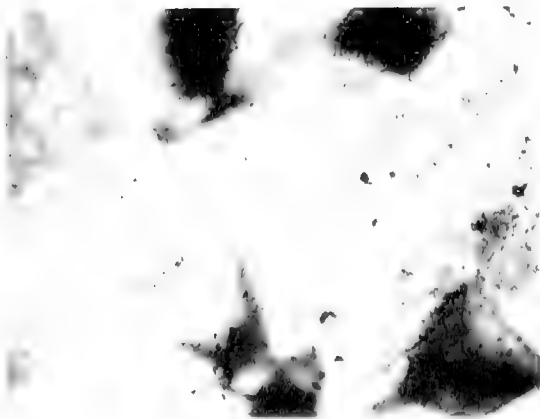
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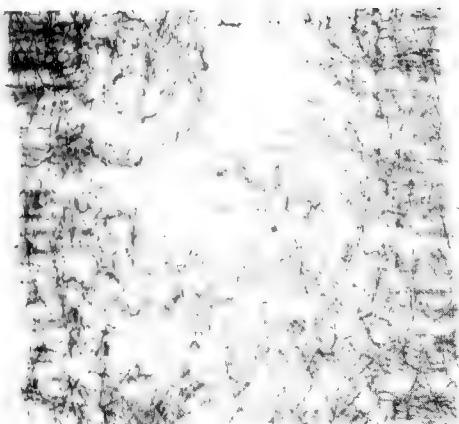
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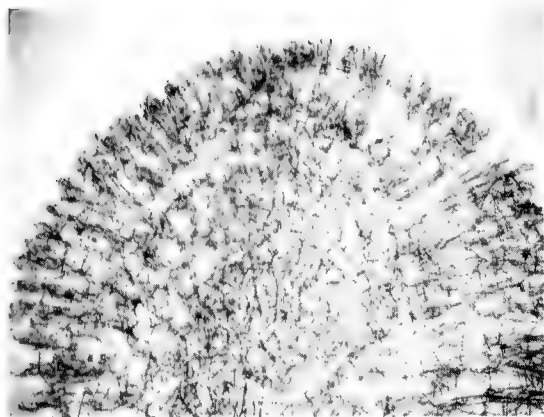
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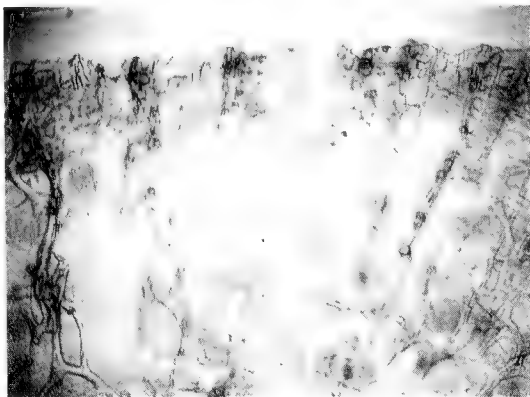
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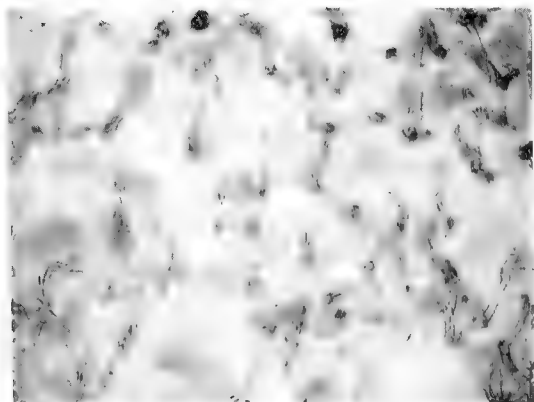
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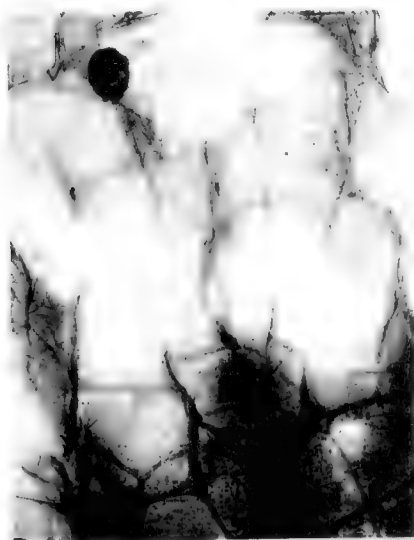
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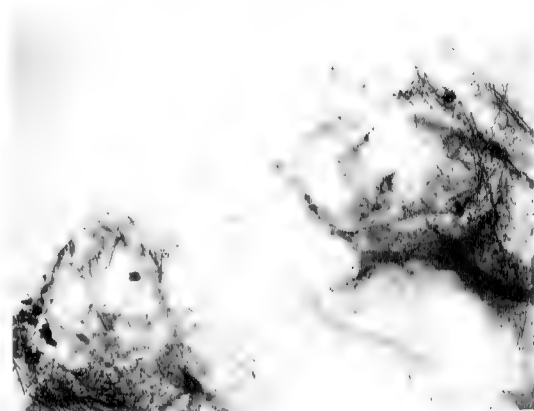
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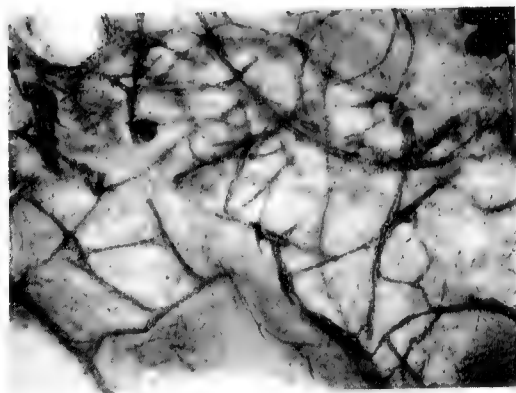
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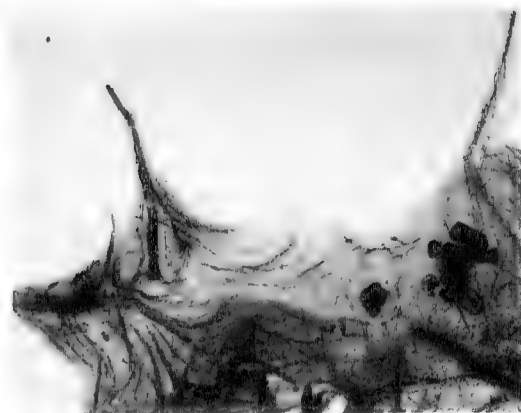
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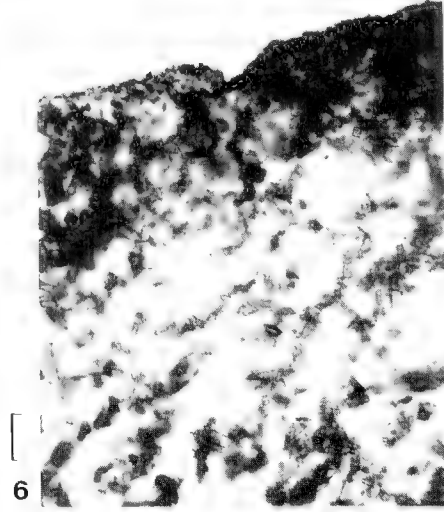
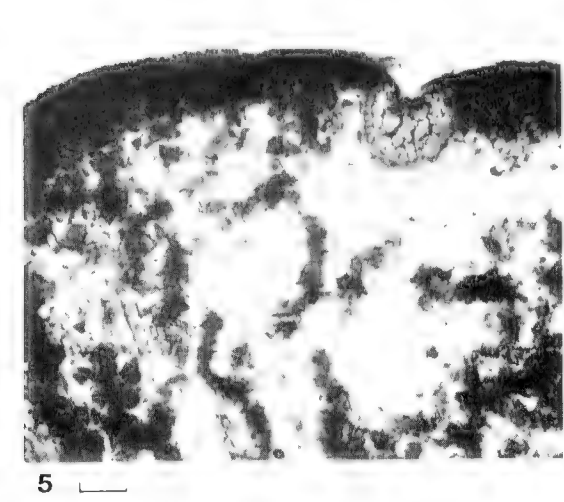
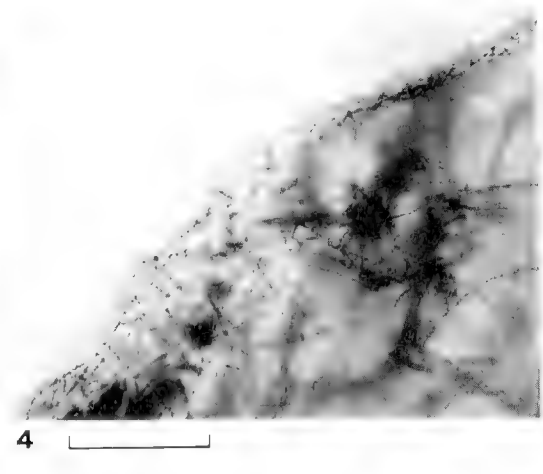
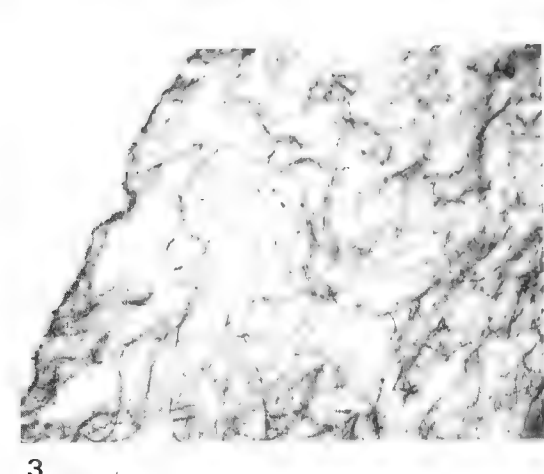
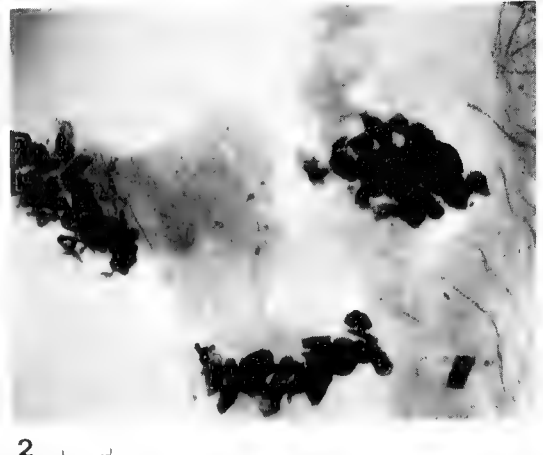
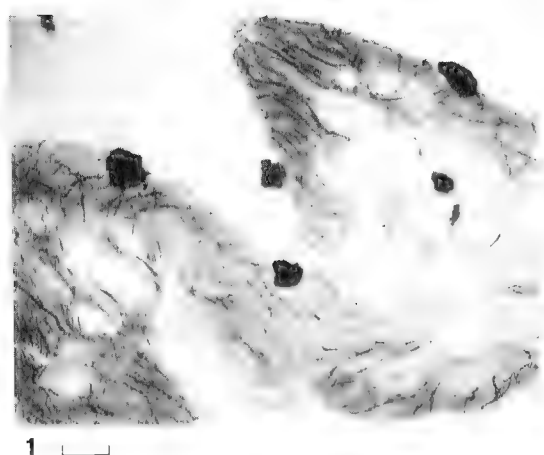
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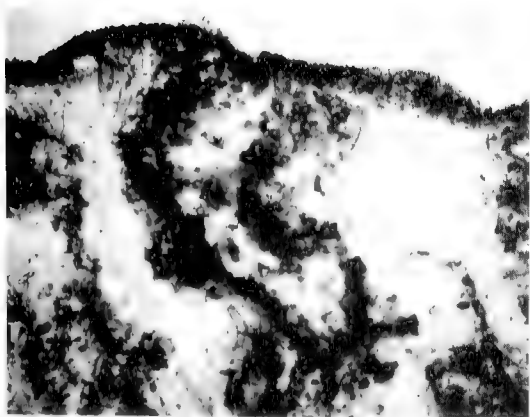


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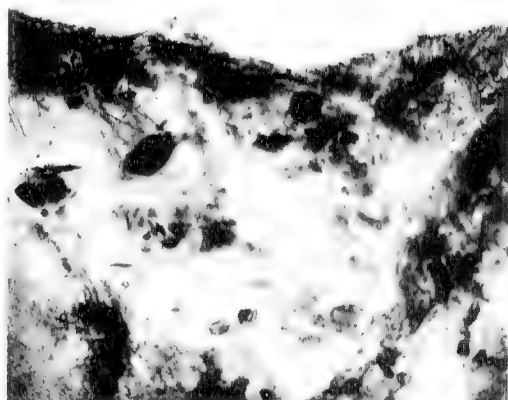


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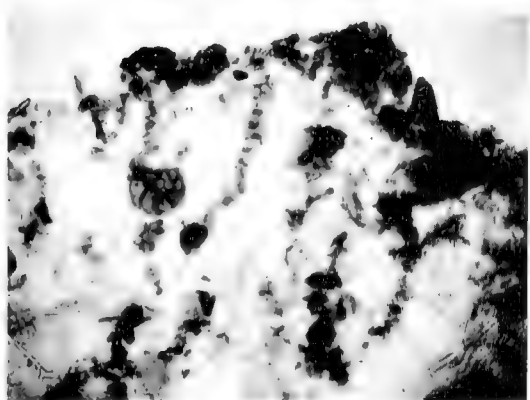




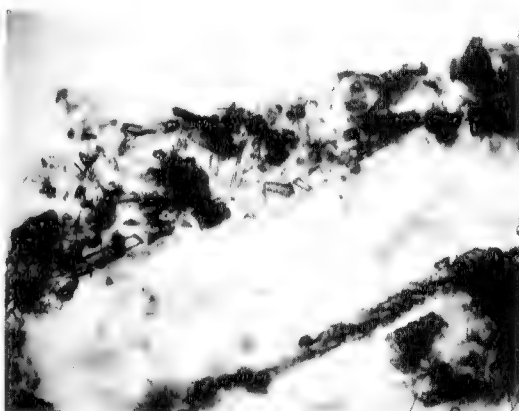
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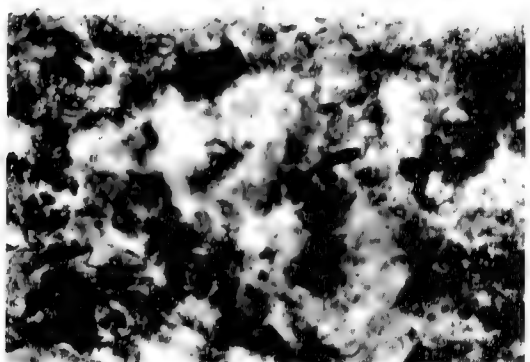
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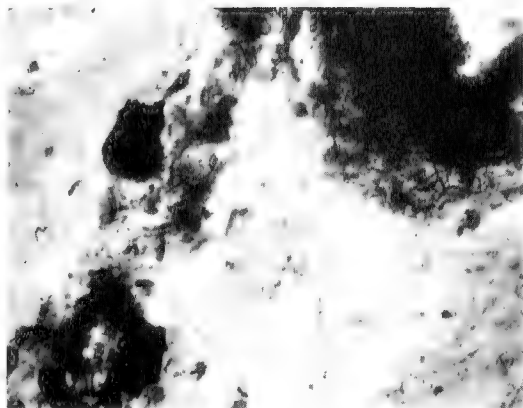
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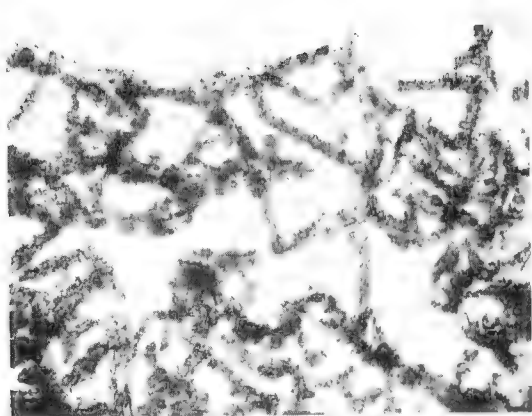
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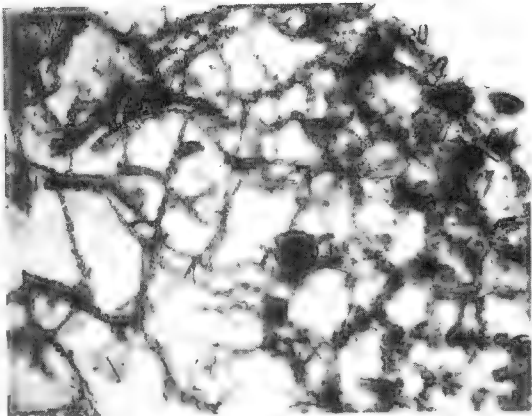
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6



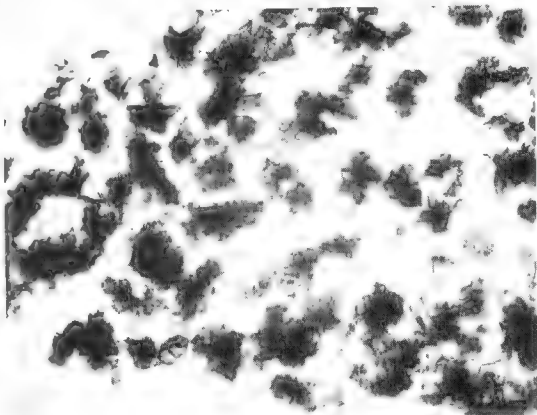
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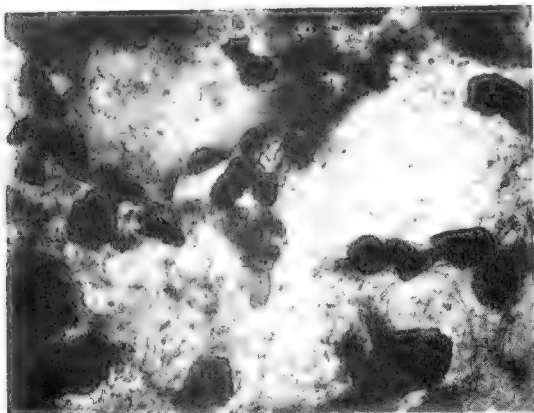
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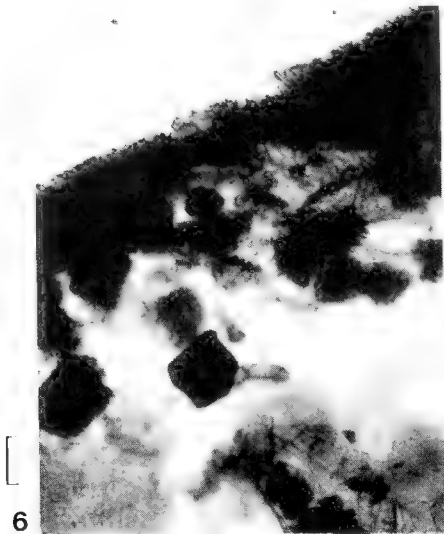
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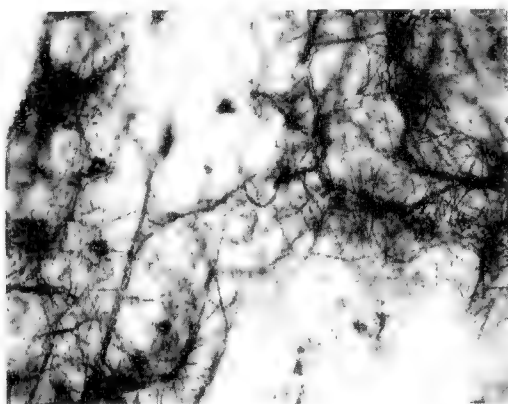
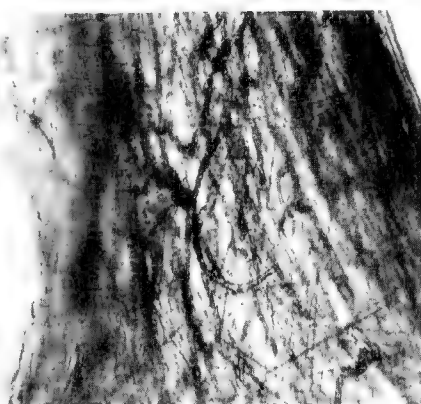
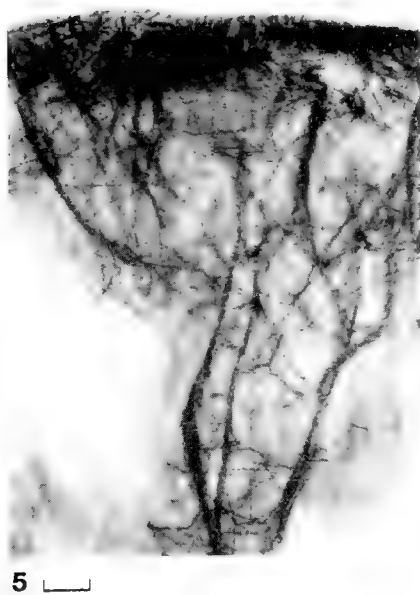
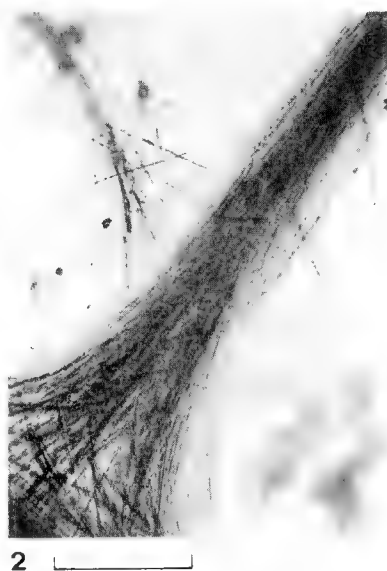
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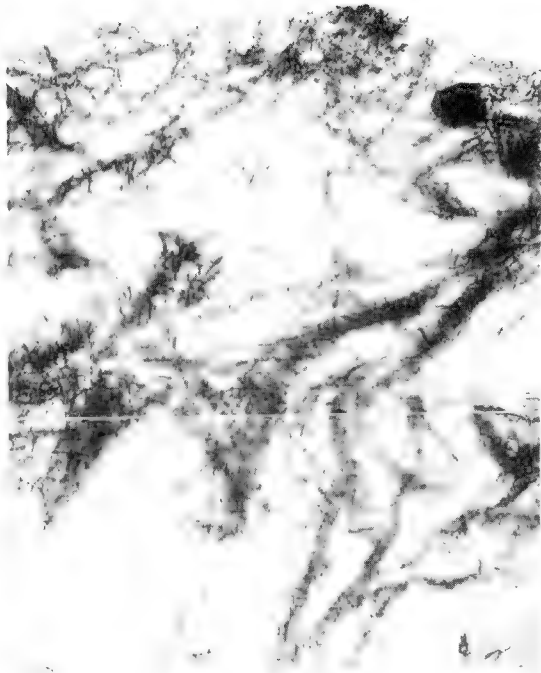


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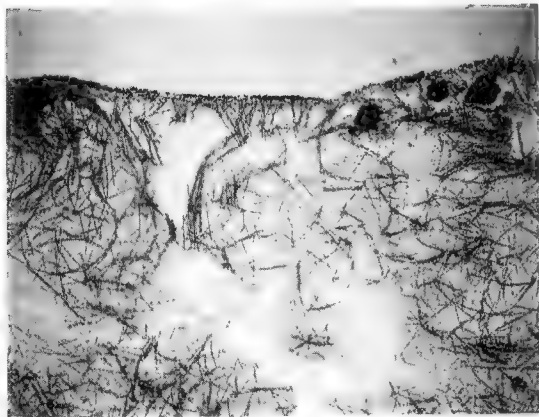




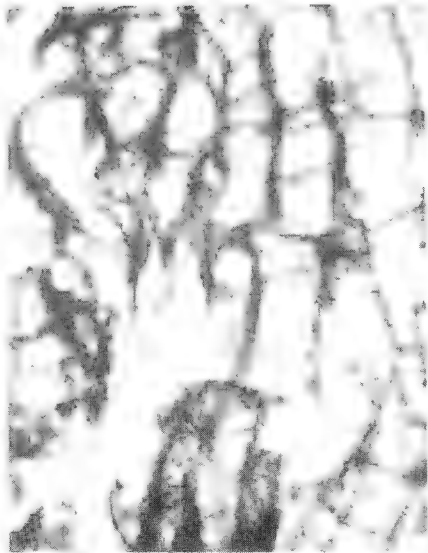
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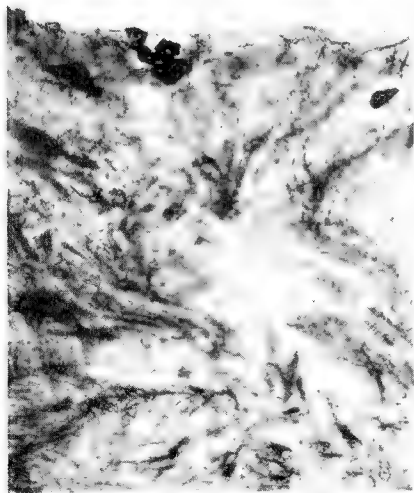
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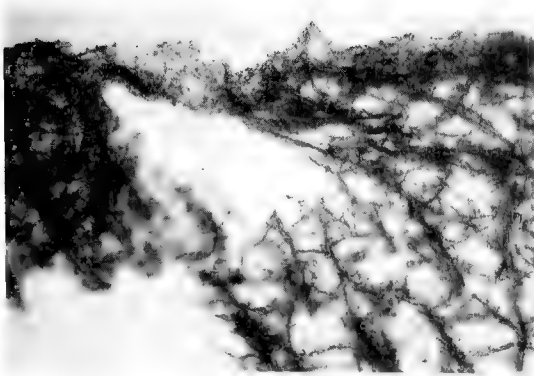
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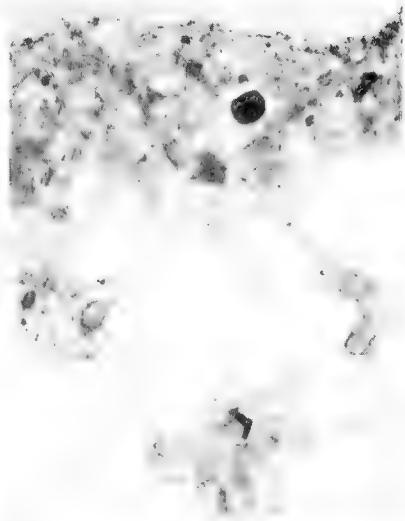
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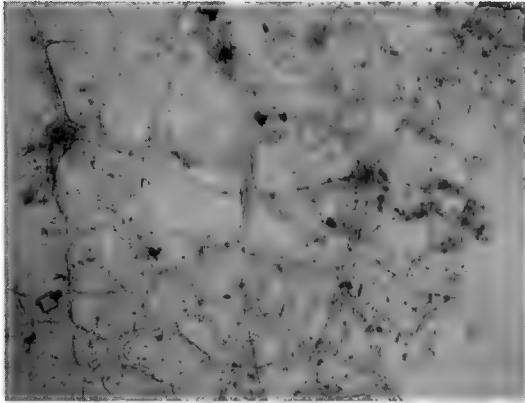
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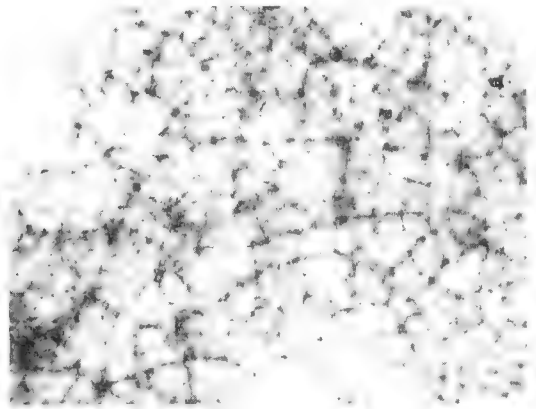
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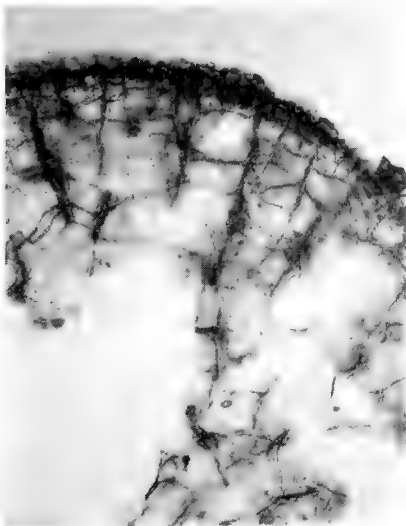
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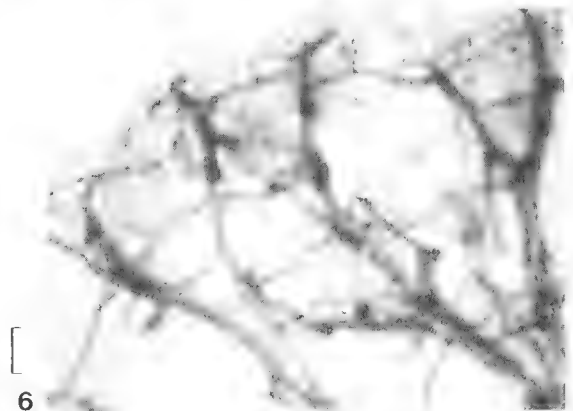
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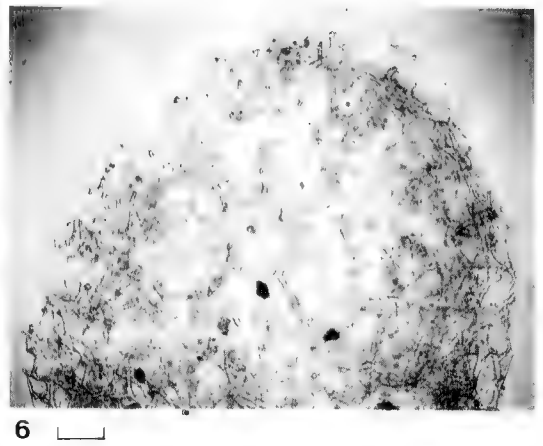
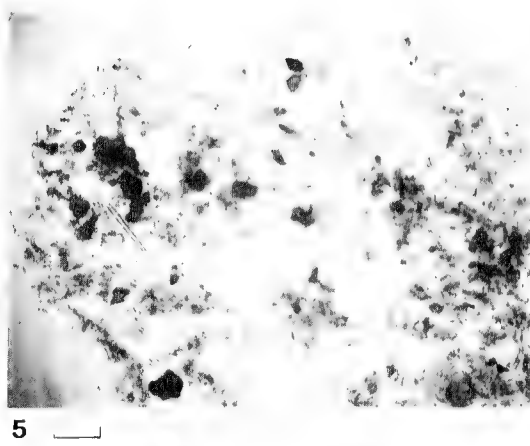
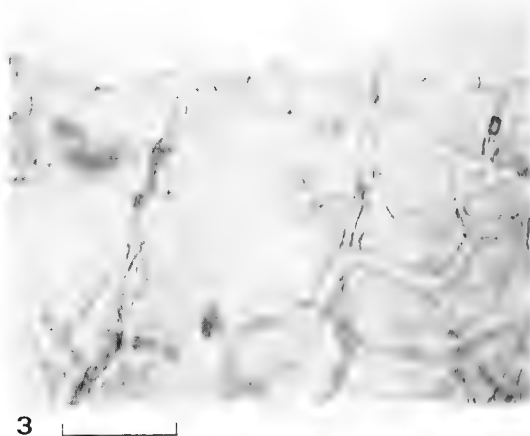
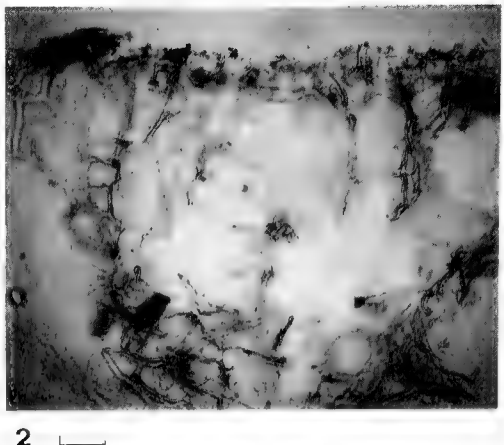
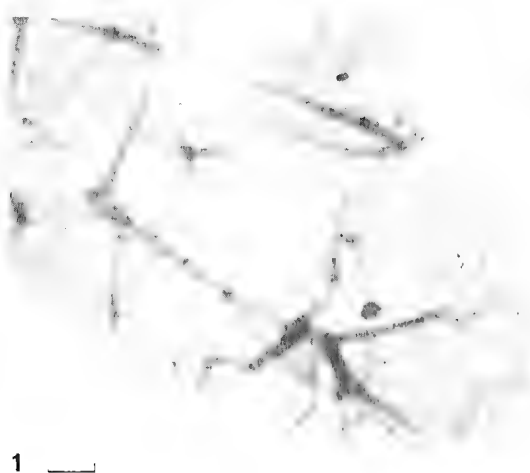
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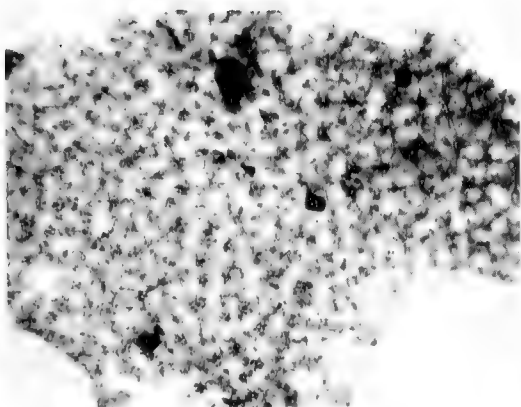


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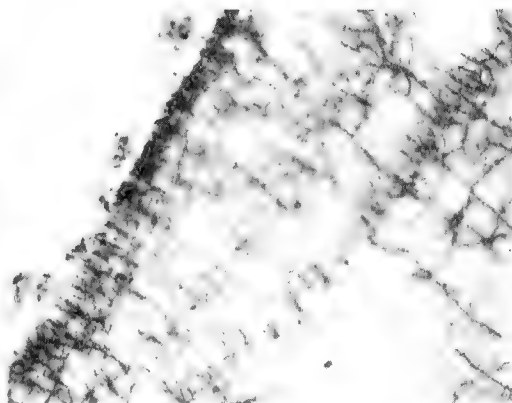


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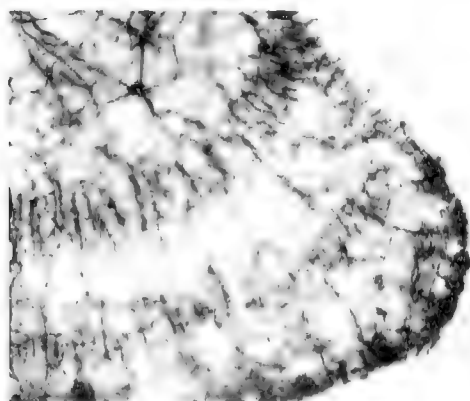




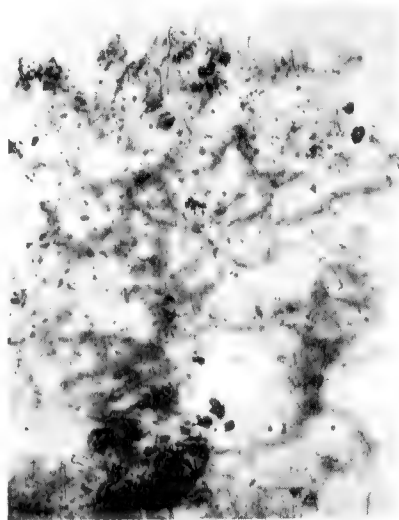
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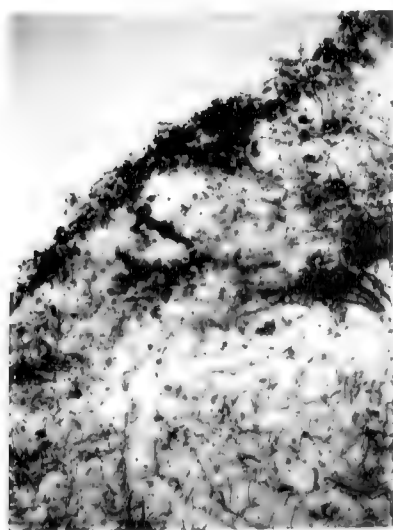
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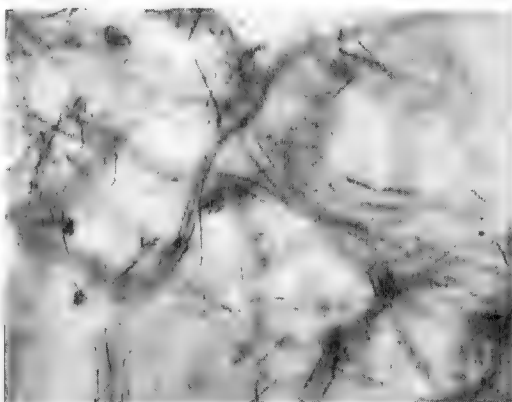
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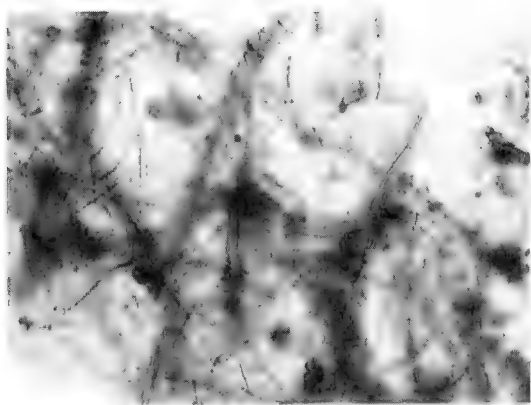
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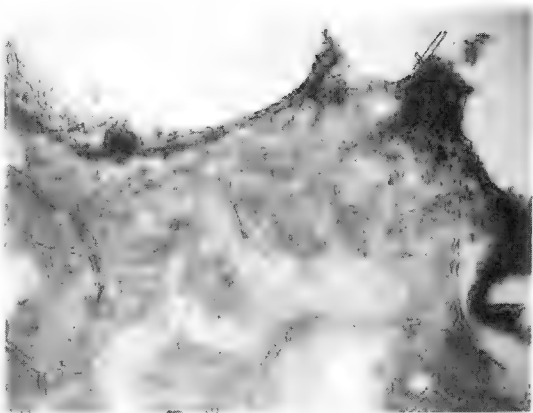
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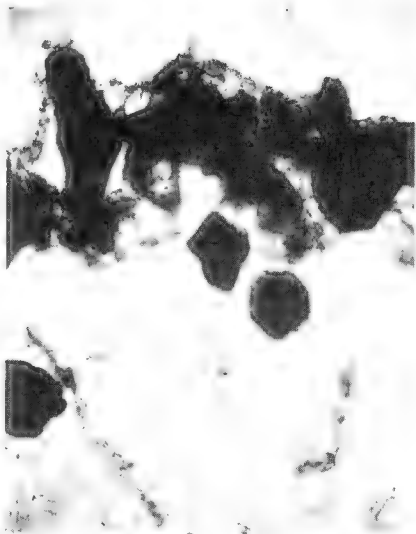
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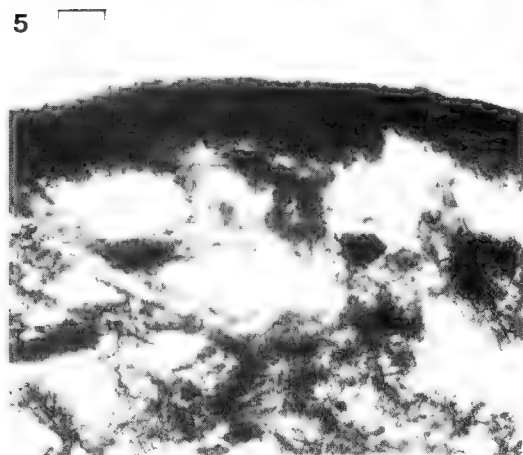
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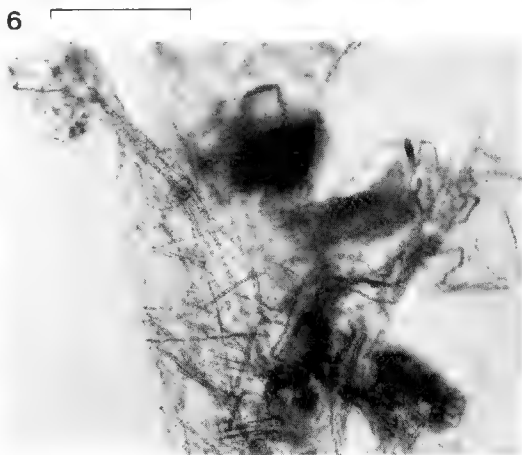
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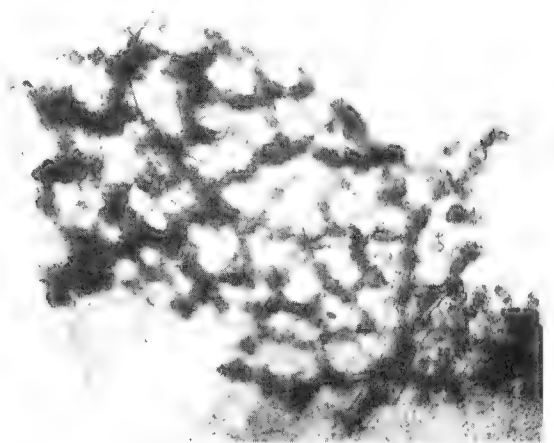
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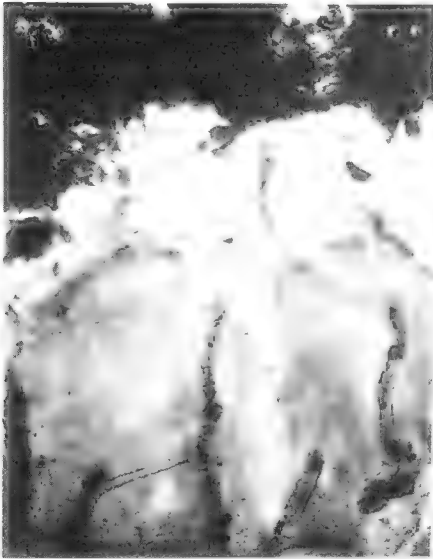
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1 —



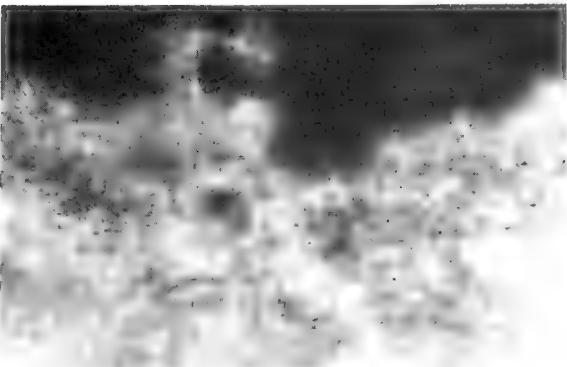
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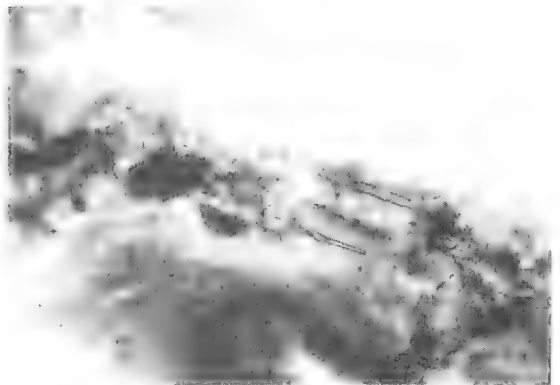
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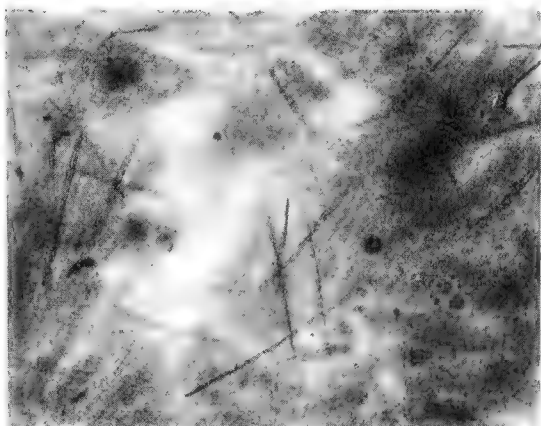
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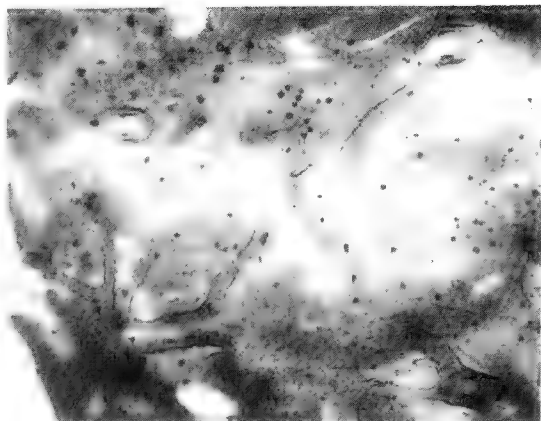
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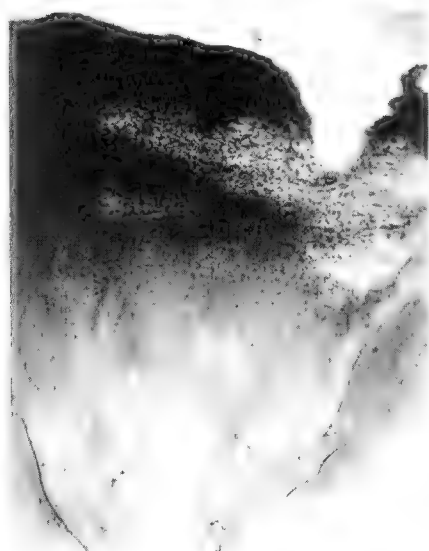
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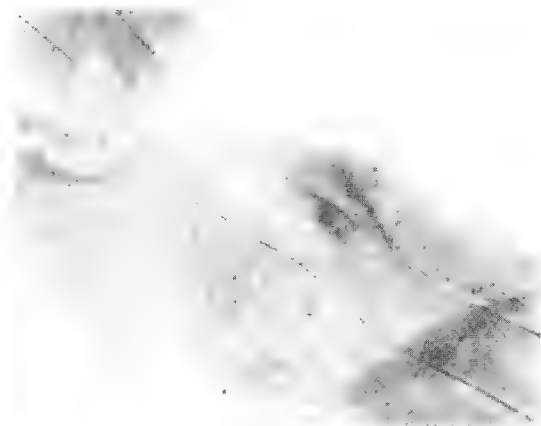
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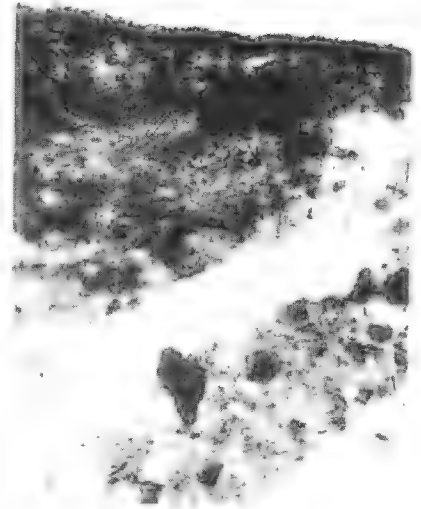
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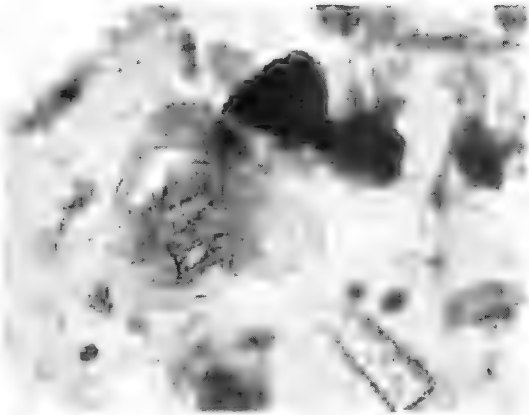
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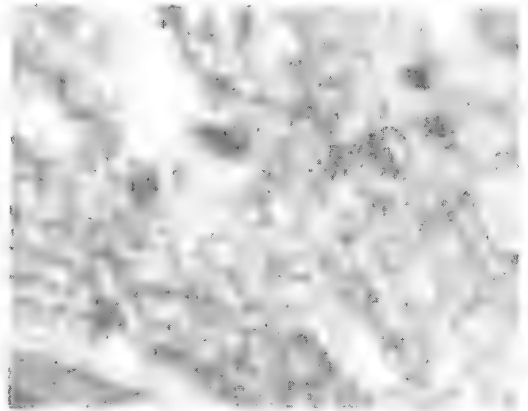
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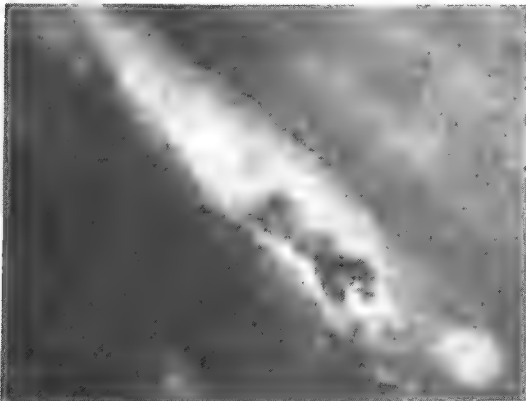
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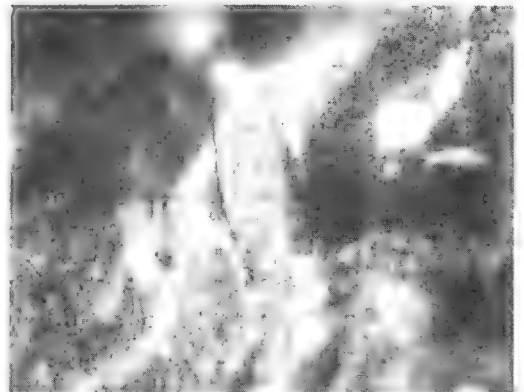
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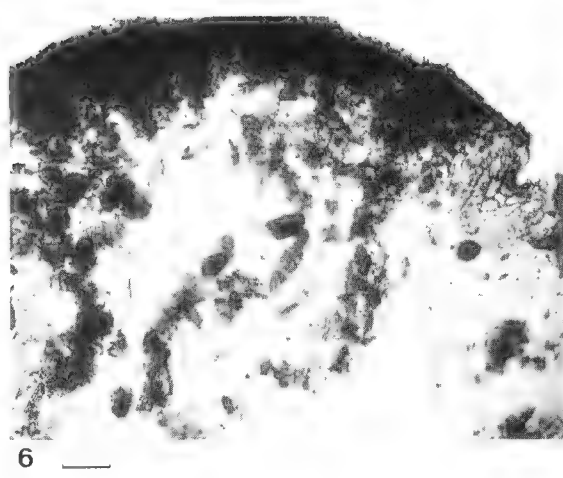
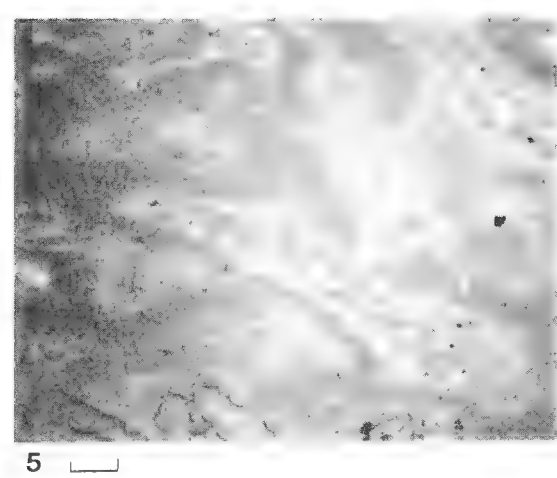
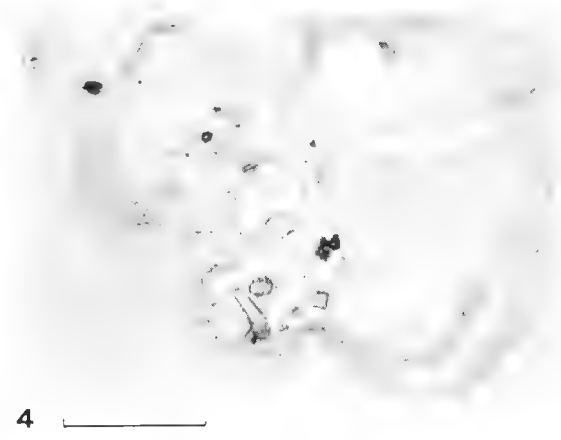
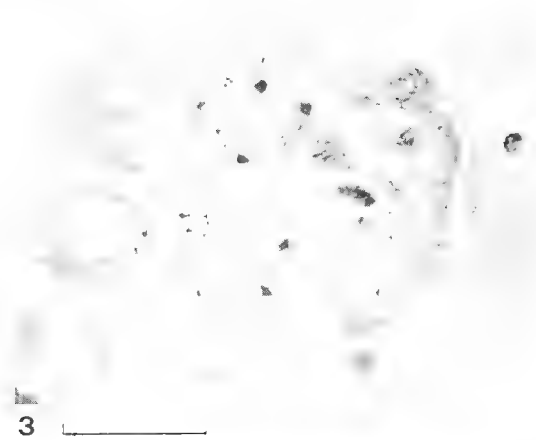
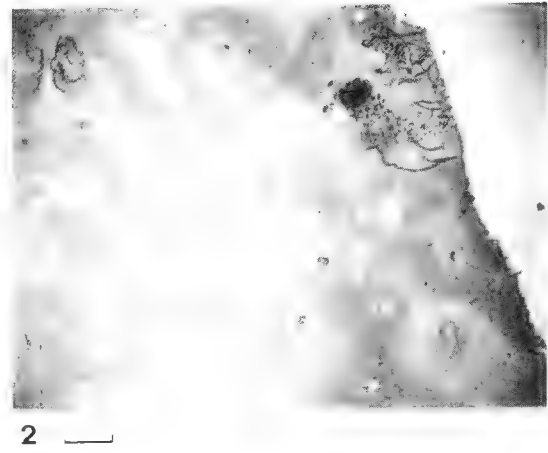
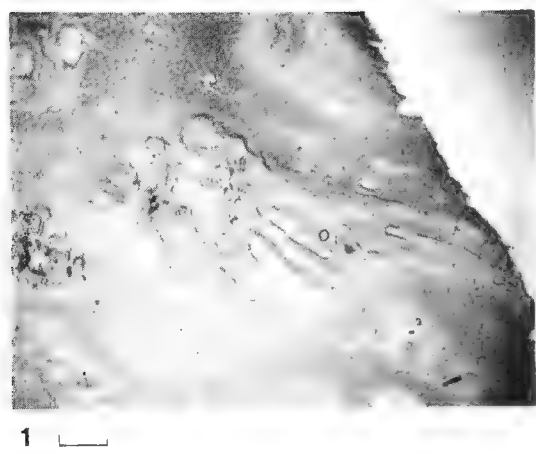
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